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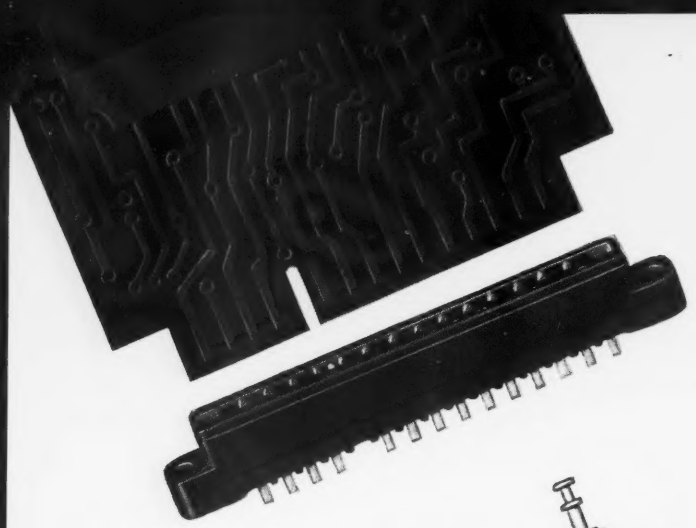

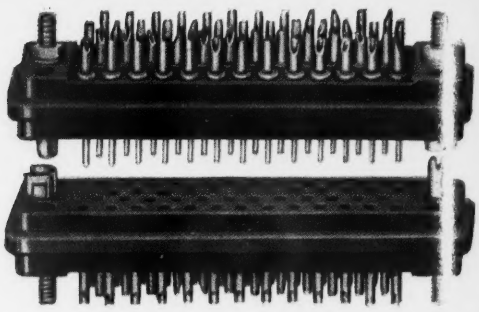

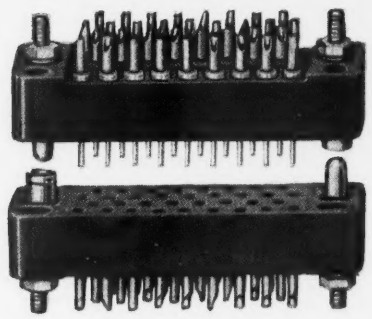

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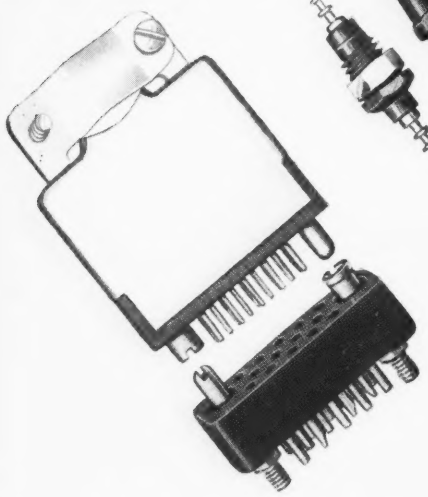

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ELECTRICAL REVIEW

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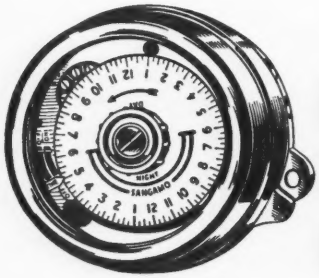

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ELECTRICAL REVIEW

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Preparing for Automation

MUCH of the discussion at this year's Trades Union Congress showed a disregard, or misinterpretation, of economic facts. However that may be, there was one subject, automation, which was dealt with in a realistic way. When automation first became prominent there was a tendency for the trade unions to view it with the same fear and opposition as animated the Luddite rioters of over a century ago. It was regarded as a tendency which would inevitably result in widespread unemployment and it was thought that even if this fear proved to be exaggerated any benefits arising from automation would accrue exclusively to employers and shareholders.

The speeches at Brighton showed that although these fears persist automation is accepted as inevitable. None of the delegates questioned the necessity for it and indeed several welcomed it. Mr. H. G. Knight (Association of Supervisory Staffs, Executives and Technicians) said that the real danger was that unemployment in this country would arise from a lack of automation here while others were adopting it. Mr. J. Edgar (Patternmakers' Association) said that they welcomed automation " not because it has got to come and we cannot stop it, but because we want it to come."

Having accepted the idea, the delegates were concerned with preparing in good time to meet the new conditions which automation would create. It seemed to be recognised that the ultimate effect would be to raise the standard of workers in " automated " industries and concern was actually expressed lest workers in other fields did not share in this higher standard. It was agreed that it was mainly the responsibility of employers to see that " automation " was introduced gradually and in a planned way. Some speakers thought that this could be achieved only by socialist methods and in fact a resolution proposing the establishment of a national planning board to control the application of automation (which implied representation of " private " industry) was rejected, but principally because such a board would prove ineffective.

Joint consultation between the employers and the unions was considered to be the best way of ensuring a smooth transition to automation. This principle is accepted by employers but there is much more in it than that. It is suggested for one thing that ample notice should be given of forthcoming changes because of automation. Employers may be able to retain their labour force because of expanded production, switching them to other jobs if necessary, but it is unlikely that this will always be possible. What can the unions do to persuade their members to qualify for different work or seek other employment, if it comes to that? Where automation is adopted in a local industry which is the mainstay of a town new industries may have to be encouraged or large transfers of

men may have to be made. This would seem to necessitate some action by the Government.

The problems involved in automation have already formed the subject of a study by the Department of Scientific and Industrial Research which has now produced a shortened and simplified version of its report, reviewed on another page of this issue. It sets out the position very well and indicates possible lines of action even if the lines are not always clear cut.

APPLYING THE REGULATIONS

Although the I.E.E. Wiring Regulations are expressed clearly enough as regards questions of principle, those who are concerned in their application are not infrequently in doubt as to their practical bearing in specific instances. Following the precedent it set three years ago of interpreting on request the requirements of the then current 12th edition and publishing those of most general interest, the Institution has now done the same service in regard to the 13th edition (which dates from September of 1955) as summarised on another page of this issue. It is to be hoped that members will take full advantage of this facility and that the I.E.E. will find itself in a position to make the results available to the electrical public at fairly frequent intervals.

AMERICAN BREEDER REACTOR

Conditional approval has been given by the United States Atomic Energy Commission to the construction of a large breeder reactor by the Power Reactor Development Corporation—a consortium of twenty-six industrial firms and public utilities. The plant, which is estimated to cost $54·5 million, is to be erected on the Lagoona Beach, Michigan. The *Electrical World* (New York) says that the plant should start at "low level" about December, 1959, and build up to full 150 MW rating in the following year.

In the meantime, it is reported that Mr. Thomas E. Murray, atomic energy commissioner, has refused to approve the conditional construction permit issued by the A.E.C. on the ground that not enough is yet known to guarantee that the reactor will not be a "public hazard." The Commission believes, however, that the "safety problem can be resolved in due course."

The Dounreay (Scotland) breeder reactor will incorporate many devices for ensuring safety and the U.K. Atomic Energy Authority appears to be satisfied that it will operate without endangering those concerned with it.

HOURS AND WAGES

It appeared from the debate on wages at the Trades Union Congress that a number of the unions proposed to embark upon an immediate campaign for higher wages, regardless of the effect upon the country's economy and, particularly, upon export trade. Later statements were in a more temperate mood, suggesting that comments by some of the T.U.C. "elder statesmen" had had some effect. There was a realisation on the part of some speakers that higher wages could be justified only by greater output per head. Nevertheless, against the advice of the General Council, a resolution was passed proclaiming a determination to press for a 40-hour week—at a time when in most industries there is a shortage of labour. While quite legitimate as an ultimate aim, a shorter working week is hardly feasible at the moment. To press for higher wages *and* shorter hours is unrealistic.

HEAT TREATMENT OF ALUMINIUM

In "Notes on the Heat-Treatment of Aluminium Alloy Castings," a publication by Alar, Ltd., which is reviewed elsewhere in this issue, the various types of furnaces used for the different treatments referred to are briefly described and these descriptions are a further indication of the prominence in the heat-treatment world of the electric furnace.

In connection with solution treatment it is said that two types of furnace are obtainable, namely, the forced air circulation furnace and the salt bath. The forced air circulation furnace is described as one in which the castings are heated by a current of hot air maintained in rapid recirculation by a large fan within the furnace. Heating is most commonly effected by electrical resistors arranged round the wall of the furnace, but furnaces fired by gas or other fuels are obtainable. We have yet to hear of gas or other fuel resistors arranged round the wall of a furnace. Again it is said that the salt bath consists essentially of a steel tank containing sodium nitrate or a mixture of sodium nitrate and potassium nitrate, heated either internally by immersion heaters or externally by gas and oil. We think the key phrases here are "immersion heaters" and "externally by gas and oil."

NEW COMMUNICATIONS SYSTEM

During this century there have probably been more developments in the field of electrical communications than in any other branch of electrical science. Despite all the work which is done many problems still have to be solved and a number of the existing communication systems are far from ideal. For instance, reliable communication, with privacy, over long distances is not at all an easy matter. However, a development has recently been made by the Canadian Defence Research Board whereby the trails of ionised particles left by minute meteors entering the atmosphere of the earth are used to reflect radio waves. Signals can be transmitted over a distance of 1,000 miles in this way, the transmitters and receivers being switched on and off automatically, depending upon whether or not a meteor trail is present in a given position. Apart from ensuring privacy owing to the spasmodic and limited nature of the reflecting medium the system will help to alleviate the present overcrowding of the h.f. band since it operates on a very narrow bandwidth.

Next week's "Electrical Review" will be a special lighting issue. It will contain the address by the president, Mr. H. Carpenter, and papers presented at the annual conference of the Association of Public Lighting Engineers (Blackpool, 18th–21st September), with a survey of the exhibition. Special articles will include one by Mr. Carpenter on the Blackpool illuminations for which he is responsible

Impulse Testing of High-Voltage Cables

Some Problems and Recent Developments

By B. SALVAGE, B.Sc.(Eng.), Ph.D., A.M.I.E.E., and E. A. SMITH, Assoc.I.E.E.*

PRESSURE cables of the oil-filled and the various gas-pressure types were originally introduced some twenty to thirty years ago to operate at voltages above 33 kV. At these higher voltages, cables of the so-called "solid" type are uneconomic, if indeed practicable, since very large insulation thicknesses would be required in order to limit the working stress and thereby ensure that breakdown did not occur in service as the result of the action of electrical discharges in gaseous voids in the insulation.

Pressurising the dielectric either to eliminate gaseous voids, as in the oil-filled cable, or to increase their electric strength, as in gas-pressure cables, enables much higher working stresses to be used, but very little improvement, if any, is obtained in the impulse breakdown strength of the dielectric by this means. It is now recognised that, whereas the design of solid-type cables is governed by the need to obtain an adequate electric strength under normal power-frequency voltages, the permissible insulation thicknesses of pressure cables are determined by the impulse breakdown strength of the dielectric and the specified impulse withstand voltage appropriate to the voltage of the system in which the cable is to be connected.

Various types of pressure cable have now become well established. Since the end of the war there has been a marked growth in their installation both in this country and abroad, and their importance will undoubtedly grow. Much effort has been directed towards increasing their working stresses and hence cheapening their cost, and considerable reductions have also been made in the size of the associated joints. Pressure cables incorporating oil-impregnated paper dielectrics have been developed for use at the highest transmission voltages at present being employed, and in many instances they are now chosen in preference to solid-type cables at 33 kV in view of the thinner insulation which is required and the higher operating temperatures which are possible.

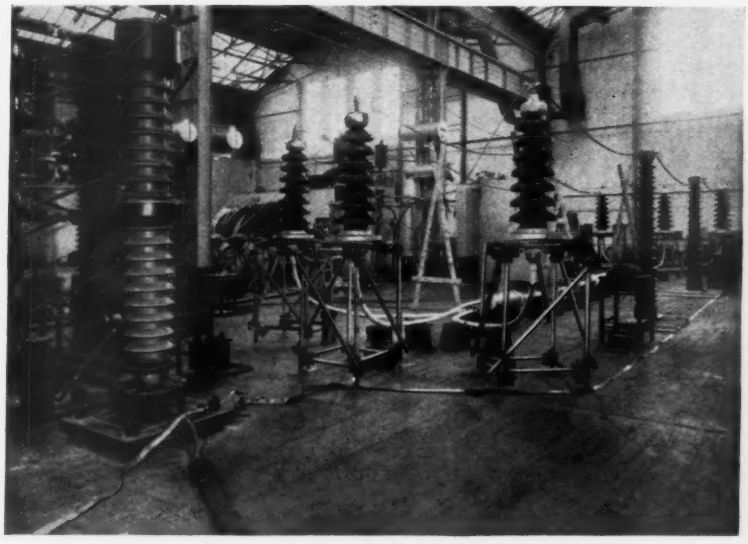
The importance of the impulse testing of electrical power transmission equipment is now well understood, and it will be appreciated that it has a special significance for the cable engineer in regard to pressure cables. It is the purpose of this article to review some of the problems which arise in impulse testing high-voltage cables and their associated joints and terminations, with special reference to the more recent developments in this field.

Many of the problems encountered in making impulse tests on high-voltage cables are common to all forms of impulse testing, e.g. the use of a voltage divider and a high-speed cathode ray oscillograph for voltage measurement. When testing cables, the calibration of the generator output voltage follows normal practice using sphere-gaps and it is usual to calibrate at a voltage of approximately 95 per cent of the withstand test voltage. Repeated application of voltage impulses just below the impulse breakdown voltage of an oil-impregnated paper insulated cable results in only a small reduction in impulse strength and calibration in this manner should in no way affect the cable's ability to pass the withstand test. Calibration at two other, lower, voltages to account for any non-linearity in the generator circuit, if this exists, and with both polarities, is advisable.

Adequate bonding of the earthy sides of the test object, voltage divider, sphere-gap, if in use, and the impulse generator, is essential. Copper tape about 2in wide is recommended for this purpose, all lengths being as short as possible and connected together at the base of the generator. The generator should be earthed through reliable electrodes, but the authors have found that good bonding of the test components, as outlined above, is more important than the maintenance of a very low resistance earth. The connection to the cable sheath should be made immediately below the termination connected to the generator in order to reduce the circuit inductance external to the generator; measurements on typical test lengths have shown that with this arrangement there is a negligible difference in the peak voltage along the cable. It is good practice to have the whole test circuit as compact as is practicable, again to reduce the circuit inductance. By these means the voltage drop in the earth return leads is also kept as small as possible.

It is now the usual practice to apply ten negative, followed by ten positive impulses at the withstand test voltage and to repeat this procedure when continuing the test to breakdown, the voltage increasing in steps of about 5 per cent. There is, however, only a slight polarity effect,

* W. T. Henley's Telegraph Works Co., Ltd.



132 kV three-core oil-filled cable system prepared for impulse testing at elevated temperature (Henley h.v. research laboratory)

for example, the impulse strength of 33 kV solid-type cables is some 10 per cent higher with positive than with negative impulses.

Recording Problems

The impulse plant in the Henley high-voltage research laboratory, of which the authors have had most experience, comprises a seven-stage Marx-type generator having a capacitance of 0·175 μF per stage and producing a maximum open-circuit voltage of 1,200 kV, and a capacitance voltage divider. It may be of interest to describe some of the recording problems which were encountered when the apparatus was put into commission; no difficulty was experienced in operating the generator but the recorded waveform was initially far from satisfactory, the wavefront having three or more bands of oscillations with frequencies ranging from 4 to approximately 80 Mc/s.

The main disturbance had a frequency of about 20 Mc/s, and since at this frequency the impedance of a normal cable sample is much lower than the usual wavefront resistance in the impulse generator (about 200 ohms), it was concluded that voltages of the magnitude recorded could not be appearing across the actual cable sample.

It had previously been shown by Elsner,[1] in Germany, and by Miller,[2] in an investigation on the Henley plant, that voltages having a frequency of this order are produced in the generator structure on the breakdown of the spark gaps, and the possibility that the recorded oscillations were due to direct coupling between the generator and the capacitance voltage divider was investigated. Additional inductance was inserted in the generator and the stray capacitances within the generator were varied, but the recorded frequency and amplitude were unchanged. It was concluded, therefore, that the disturbance although initiated by the generator was controlled by oscillatory circuits outside the generator structure. Having eliminated the generator, the recording circuit was investigated and the source of a 20-30 Mc/s band of oscillation was located in the low-voltage arm of the divider. By re-arranging this section and employing low resistance screening material with welded joints this band of frequencies was eliminated completely.

Oscillations on the wavefront having frequencies from 4 to 10 Mc/s were next investigated and it was shown that these were generated in the circuit formed by the test object and voltage divider, since the circuit possessed appreciable inductance and capacitance but negligible resistance. These oscillations were effectively damped out by the insertion of a suitable resistance in the high-voltage connection from the test object to the voltage divider, and it can be shown that the errors in the recorded peak voltage and wavefront are negligibly small provided that the time constant of the series combination of the resistance and voltage divider capacitance is less than one-tenth of the wavefront.

Having made these improvements in the recorded waveform further high-frequency oscillations having a frequency of 60 Mc/s were apparent. These oscillations were present when the voltage divider was disconnected from the cathode ray oscillograph, and the Y-deflection and trapping plate circuits in the cathode ray oscillograph were accordingly suspected. It was found that full double-screening of the complete circuitry and connections to the plates was essential and the 60 Mc/s oscillation was eliminated on completing this screening over the ports to the trapping plates.

Figs. 1 and 2 are oscillograms of the recorded wavefront initially and after making the improvements outlined above.

One of the principal difficulties associated with the testing of high-voltage cables arises from the large capacitance of the test object. Cable capacitance is, of course, dependent on the conductor size and the insulation thickness—for example, a 0·2 sq in, 132 kV, pressure cable of modern design will have a capacitance of about 170 $\mu\mu$F per yd, whereas the capacitance of a 0·6 sq in, 33 kV, pressure cable is about 900 $\mu\mu$F per yd. This means that a miniature pressure-cable system complete with joints and terminations may have a capacitance of as much as 0·005 μF or more, even though the length of cable is kept as short as possible. Accordingly, an impulse generator having a large discharge capacitance is required, in order to obtain a reasonable voltage efficiency. Further, to produce a nominal one-microsecond wavefront as specified in B.S. 923:1940 a small internal inductance is essential; the larger the inductance, the greater is the wavefront resistance needed to damp out high-frequency voltage oscillations in the test circuit, and when a short wavefront is required with a large capacitance load, the amount of wavefront resistance which it is possible to insert is very limited. Nevertheless, even with an impulse generator having a large discharge capacitance and a small internal inductance it has sometimes been found impossible to obtain a nominal one-microsecond wavefront when testing a miniature cable system of large capacitance.

Research work performed in the high-voltage laboratory of the National Physical Laboratory on the impulse breakdown characteristics of 33 kV solid-type cables has shown, however, that the impulse breakdown strength is not affected by increasing the wavefront beyond the one microsecond nominal value, and is, in fact, unchanged when a wavefront of as long as 11 microseconds is employed.[3,4] In view of this, it is now usual to specify a wavefront time of up to 5 microseconds. This relaxation is undoubtedly of considerable assistance and enables longer cable samples to be tested if desired, but it should be added that it seems very unlikely that it will be possible to test complete drum lengths using present techniques.

Tests at Elevated Temperatures

Recent research has shown that the impulse strength of oil-impregnated paper-insulated cables decreases when the dielectric is heated above ambient temperature, and in accordance with the principle that equipment should be tested under the most severe conditions likely to be experienced in service, it is now the practice to perform impulse tests on cables with the conductor heated to the maximum operating temperature, which for pressure cables is at present 85 deg C.

Various methods of heating the cable are possible, by,

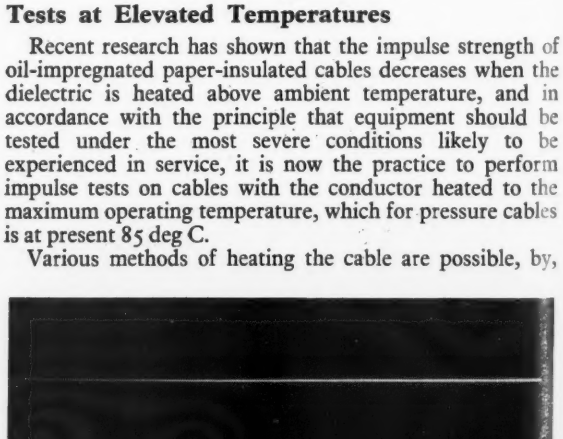


Fig. 1.—Oscillogram showing wavefront initially recorded (frequency of timing oscillation is 1 Mc/s)

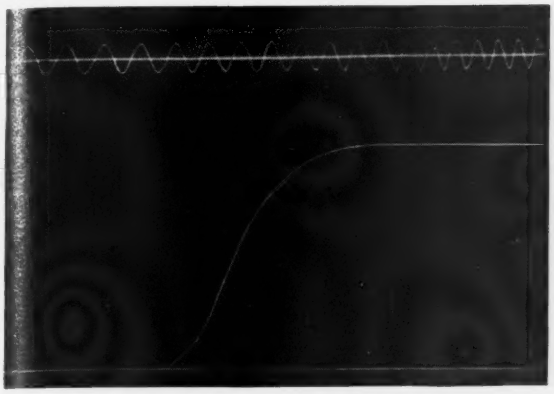


Fig. 2.—Oscillogram showing wavefront recorded after completion of improvements outlined in the text (frequency of timing oscillation is 5 Mc/s)

for example, conductor current heating, sheath current heating or applying heating wires or pads to the outside of the cable.

Of these arrangements, the first gives temperature conditions within the cable most closely resembling those occurring in normal operation. Sheath heating results in the whole of the cable dielectric being heated to the same temperature—a condition which is not experienced in practice—and it is very difficult, if indeed possible, to heat any joints in the cable to the maximum operating temperature by this means and quite impossible, of course, to heat the terminations. For these reasons conductor current heating is to be preferred.

It is very desirable that the current heating should be maintained during the actual course of the impulse test, but any equipment connected directly to the cable conductor in order to supply the necessary loading current, for example, a generator or current transformer, would have to withstand the full impulse test voltage. For a 132 kV cable this voltage will be upwards of 640 kV (peak), and it will be appreciated that very elaborate and costly apparatus would be needed. To overcome this problem, "ring-type" transformers are now commonly being employed, one or more being positioned along the test sample as required. Each transformer consists of a rectangular core, the top being detachable for ease of application, with the primary winding arranged on the two vertical limbs and supplied through the usual types of voltage controller from the mains. The cable conductor threads the magnetic circuit and is short-circuited so as to form a single-turn secondary winding.

The authors have found it advantageous to connect the core of each transformer direct to one end of the primary winding. If the core is connected to the sheath of the cable under test, it is possible that when very high voltage impulses are applied to the system, surge voltages having peak values up to several kilovolts to earth may be produced at points along the cable sheath and these surges will develop between the core and parts of the primary winding at or near earth potential; similar difficulties may be experienced if the core is connected to earth. Any risk of damage to the insulation of the primary winding is removed by connecting the core to one end of the primary winding, provided, of course, there is adequate clearance or insulation to eliminate the possibility of spark-over between the cable sheath itself and the primary winding.

Measurement of the conductor temperature within the test object cannot be made accurately by the change of resistance method. As the length of the test sample must be fairly short, for the reasons given previously, there is a considerable cooling effect associated with the terminations of the cable, with the result that the maximum conductor temperature is several degrees higher than the mean temperature. It is possible, however, to calculate the maximum conductor temperature from measurements of the sheath temperature, given by thermocouples placed at intervals along the sheath, and from a knowledge of the internal thermal resistance of the cable, determined either from tests on a specially prepared sample or from the design data. The error in this temperature measurement should be less than 2 deg C.

The photograph shows a 132 kV, 3-core, oil-filled cable system complete with joints and terminations erected in the Henley high-voltage research laboratory for impulse testing. All three cores have been prepared for testing and an indication is given of the large area of floor space needed for an impulse test on a cable system of this type—incidentally, the cable shown is the first 132 kV, 3-core, oil-filled cable to be manufactured and installed in Great Britain. The ring-type transformers and short-circuiting leads can be seen in the illustration. The short-circuiting lead of the core which is about to be tested is supported by 275 kV sealing ends which provide ample insulation to earth; the leads of the other two cores are held in position by simple wooden structures.

In one recent instance experienced by the authors it was not found possible to maintain the conductor current heating during the actual test. The test was on a 132 kV oil-filled cable system terminated at one end by an oil-immersed sealing-end as used in switchgear or transformers. The sealing-end was made up in a steel tank which was filled with transformer oil. The ring-type transformer method of conductor current heating was used, one end of the short-circuiting lead being connected to the oil-immersed termination. The impulse flashover voltage between this lead and the tank, over the surface of the oil, would have been much lower than the withstand test voltage, so it was necessary to remove the lead and thereby discontinue heating while impulses were applied. Before the start of the test, a cooling curve giving the relationship between the mean cable conductor temperature and time was obtained. The cable sample was then heated to the maximum required temperature, the lead to the plug-in sealing-end was removed, and ten negative impulses at the withstand voltage were applied. The heating was then re-established and when the cable system was again at the maximum temperature the short-circuiting lead was once more disconnected and the ten positive impulses applied. The time during which the heating was interrupted did not exceed five minutes and it was estimated that the drop in the maximum conductor temperature was no greater than 10 deg C during this period. Since the impulse strength of oil-filled cables decreases by less than 5 per cent between ambient temperature and 85 deg C, the error introduced by not maintaining the heating current while impulses were applied was very small. This point was covered by subsequently continuing the test to breakdown.

Fault Detection and Location

Fault detection in a cable system presents none of the difficulties which confront the transformer engineer, breakdown being very clearly indicated by the impulse voltage waveform recorded on the cathode ray oscillograph. A rapid decrease in voltage completely to zero is typical of a radial cable breakdown and Fig. 3 is an oscillogram illustrating breakdown in a 66 kV oil-filled cable. An abrupt fall of about 90 per cent of the voltage followed by a much more gradual decay to zero is characteristic of a "long-path" failure produced, for example, by internal flashover along the surface of the cable insulation in a

termination, or by a breakdown along a cable core chamfer in a joint; Fig. 4 is a record obtained during a breakdown test on a screened joint in 33 kV gas-cushion cable. The interpretation of the recordings made during impulse breakdown tests on high-voltage cables and joints has been discussed elsewhere in greater detail by one of the authors.[5]

After breakdown has occurred in a cable system during an impulse test, and its position is not readily apparent, it is usually advisable to examine each component carefully in turn to locate the fault, and not apply any further voltage. If, for any reason, a rapid location is required, it can be effected by "ringing" the lead in a number of places, thus sectionalising the cable system, and the current taken by each section on the application of further voltage impulses of reduced amplitude can be observed on the cathode ray oscillograph to determine the faulty component.

Impulse voltage testing techniques have now become very familiar to the cable engineer, and the behaviour under impulse voltages of the oil-impregnated paper dielectrics used in modern high-voltage cables has been investigated and their main characteristics determined. The impulse generator is used very frequently in the development of any new design of a pressure cable, or an associated joint or termination. Not only does the impulse breakdown voltage form one of the main design criteria, but an impulse breakdown test can be completed more quickly than an a.c. breakdown test. A new design of cable or accessory developed on this basis can subsequently be confirmed by an a.c. test.

The authors wish to record their thanks to Mr. W. C. Barry, manager of the research laboratories, to Mr. S. E. Goodall, chief engineer, and to W. T. Henley's Telegraph Works Co., Ltd., for permission to publish this article.

Fig. 3.—Oscillogram illustrating impulse breakdown in a 66 kV oil-filled cable (timing frequency 1 Mc/s)

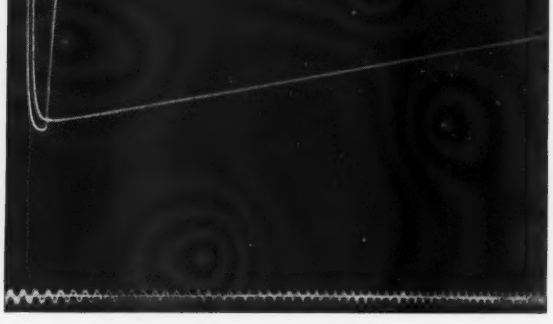


Fig. 4.—Oscillogram illustrating impulse breakdown in a joint in 33 kV gas-cushion cable (timing frequency 1 Mc/s)

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Faster Boiling Plates

ALTHOUGH electric cooking in the home is acknowledged to be cleaner, safer and simpler in operation than gas, the latter still has the appeal of a rapid initial heating up period, this being about a third faster than on a hotplate. For instance, a typical gas burner as fitted to a domestic cooker will bring one pint of water at say 60 deg F to the boil in 4½ minutes against the 6 minutes required for the same task on a 1,800 W radiant plate.

Arcolectric (Switches), Ltd., inform us that they are developing a system of hotplate control designed to speed up the initial heating period considerably. The equipment is not yet in production.

The control, which is known as the "Regustat," can be applied to an ordinary 1,800 W hotplate consisting of two 900 W circuits wound for 110 V. It has five positions and "full." In positions 1 to 5 the two circuits are connected in series across the 240 V supply to give an average input of from 100 to 1,000 W on a cycling system similar to the existing systems of infinite control. In the position marked "full" the internal switching is arranged to short circuit the outer coil in the plate and apply the full 240 V across the terminals of the inner circuit but through the main contacts of the cycling control which by means of a cam arrangement can remain closed for a pre-set period of 35 seconds, after which they open to leave the two circuits again in series. The internal heater is still in circuit and the main contacts cannot close again until switched off.

The result of this is that in switching to "full" from cold 3,400 W is applied to the plate for 35 seconds and 1,800 W after this initial period. If the control has been in position 1 and is turned to "full" the 3,400 W is applied for only 25 seconds, and if from position 5 for only 8 seconds. This arrangement safeguards the plate against prolonged overloading.

It is considered by the makers that if the high loading applied to the inner coil is limited to 35 seconds the life of the inner coil remains unimpaired. Tests have shown that, using a standard 1,800 W plate coupled to the "Regustat," one pint of water at 60 deg F can be boiled in 3½ minutes.

Manchester Lighting Course

AN evening Illumination Design Course organised by the E.L.M.A. Lighting Service Bureau is to be held at the Textile Institute, 10, Blackfriars Street, Manchester, from 25th September to 30th October. The course will cover trends in lighting practice; electric lamps; lighting design; lighting in schools, offices and libraries; lighting in industry; and shop and store lighting. Applications should be sent to Mr. A. Wilcock, E.L.M.A. North-Western Area Bureau, 36, St. Ann Street, Manchester, 2.

Industrial Influence on Public Electricity Supply

1. The Coal Industry

By JAMES F. SMITH, B.Sc., M.I.E.E.*

IN this country the words coal and power have been inseparably linked together for the past century, and the reason is not hard to find. We are a people whose standard of living has long depended on the vigour of our industry—and industry cannot exist without power which, in turn, can only be obtained in this country from coal. Coal and power have, therefore, been closely woven into the pattern of our industrial history.

It is, of course, true that a certain amount of industrial energy is derived from oil and water power, but the proportion has for many years been small and without significant effect on the overall picture. In the report of the Central Electricity Authority for the year 1954/55, the proportion of electricity generated from coal was no less than 99·2 per cent, leaving only 0·05 per cent for that generated from oil and 0·75 per cent from water power. While these figures refer to public electricity supply only, the proportions are probably true of industrial energy requirements as a whole.

The early industries of this country depended on water power and the proximity of falling water was often a deciding factor in the initial location of some industries—an obvious example being the woollen industry. The growing need for power and the advent of the steam engine radically altered the picture. New industries could be sited in proximity to supplies of coal and raw material, although the specialised human skills and craftsmanships developed in certain localities have always tended to retain particular industries in those areas, irrespective of supplies of raw materials and coal. Examples which come readily to mind are the pottery, weaving and tinplate industries.

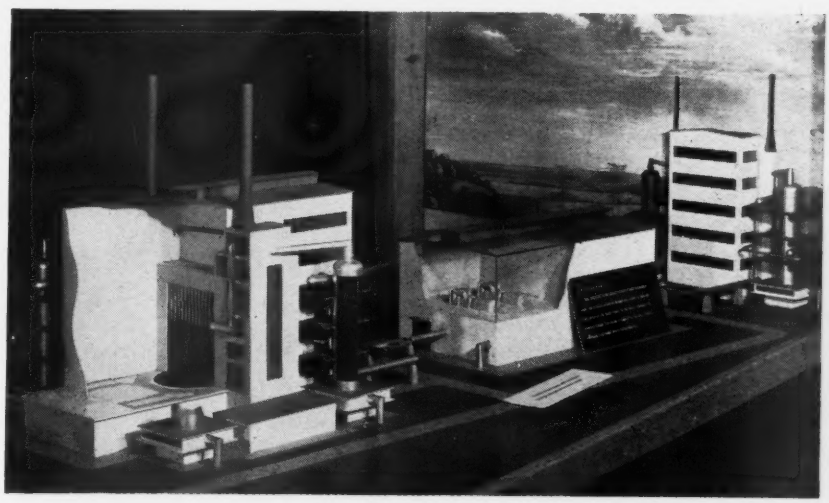
Since there was no other means of providing the energy needed in ever increasing quantities to meet industrial expansion, coal and power became inseparably linked. The coal was consumed in hand-fired furnaces to produce steam at what we would now consider very modest pressures, such steam being used to drive engines of the reciprocating type which after many years of gradual improvement and development probably reached their peak of perfection in the early part of the present century. By that time water power had dwindled to an insignificant proportion, whilst the oil engine had not yet made its entry on the industrial stage. Production and distribution of electricity on any significant scale really commenced with the beginning of the 20th century, and the whole development of electricity supply, as we know it to-day, has really taken place in the last fifty to sixty years—a very rapid growth by any historical yardstick. Throughout this development coal and power have remained inseparable, and the truth that this still applies, even to-day, will be immediately apparent to those who remember the tragic shortage of coal a few years ago which resulted in the curtailment of power supplies and the stoppage of industry for a short period over the whole country.

It is not surprising, therefore, that significant changes in coal mining and in the coal mining industry have had a profound influence on electricity supply production and, to a certain extent, distribution. The writer of this article has been associated with the coal mining, steel and electricity supply industries of South Wales for many years and realises that the views expressed in this article are necessarily coloured by what has happened in South Wales. The trend of conditions in other parts of the country, however, have been similar to those experienced in South Wales and, in what follows, the writer's views may be generally true of the country as a whole.

Wasteful Use

During the first years of the century, up to the first world war, coal was plentiful and cheap—possibly too cheap when regarded in retrospect. The higher quality, easy-to-work seams of coal were extensively and sometimes wastefully exploited. Large quantities of best coal were exported, while equally large quantities of high quality coal were consumed in this country, in many cases wastefully and, by present standards, very inefficiently. It is significant that the early contracts for electricity made by a power company in South Wales were based on coal with calorific values of 13,000 to 13,500 B.Th.U./lb, delivered into power station bunkers at 8s per ton. This was by no

* Mr. Smith is chief commercial officer of the South Wales Electricity Board and a member of the Association of Mining Electrical & Mechanical Engineers.



Model of a type of nuclear power station to be built by the Central Electricity Authority

means low-grade fuel; in fact it was quite the reverse. The separate colliery companies competed for the privilege of supplying coal to power stations, and it followed that a power station engineer was free to pick and choose, a privilege he naturally exercised to the full. He was, of course, concerned with ensuring for his power station high quality coal at the lowest possible price. In such circumstances it can well be realised that thermal efficiency held nothing like the importance it does to-day. Reliability of operation was the watchword, and it was clearly more important to ensure that at least the coal was of such a quality as not to cause trouble such as outage or shortage of steam capacity, than to worry about efficiency in converting the energy in the coal to electricity. It was, of course, fully realised that the limit of practical thermal efficiency was governed by the temperature range of the cycle through which the steam passed. Higher pressures and temperatures could only be achieved to the extent that advances in metallurgy and design permitted and, as always, the way of the pioneer who tried to adopt higher pressures and temperatures tended to be hard, i.e. he suffered the breakdowns and others learnt thereby. In these early years of the century there was indeed great inducement to continue with well-tried practice in respect of pressures and temperatures, to buy the best coal at the lowest possible price, obtain high reliability, and not take too much notice of thermal efficiency.

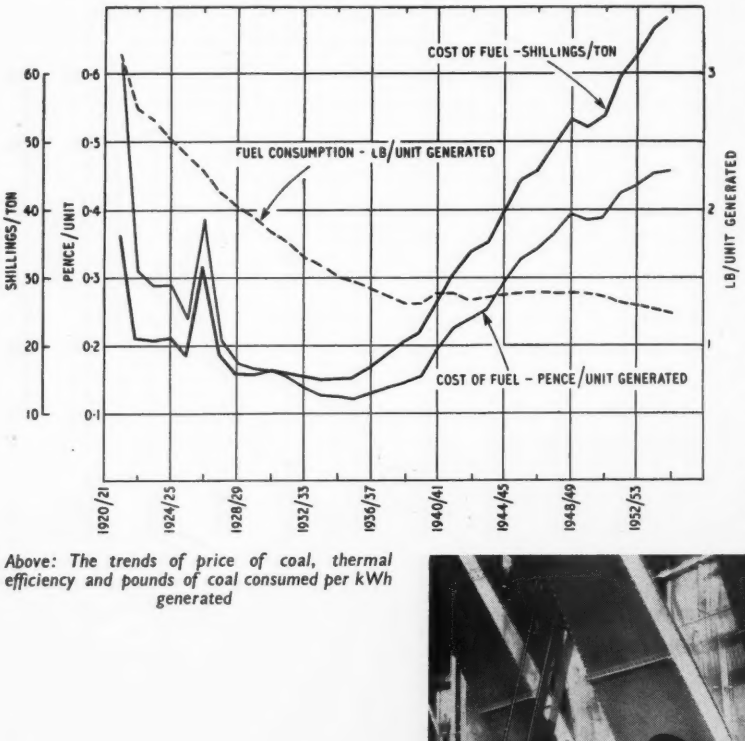
It was perhaps not until the 1930's that the position began to alter appreciably. The claims for higher wages in the mining industry could no longer be denied and, as a result, the cost of coal gradually increased until coal clauses in power supply contracts became based first on 10s, then on 12s 6d and later on 14s 6d per ton.

This rising cost of coal gave added impetus to the trend towards the adoption of generating plant of the maximum efficiency which could then be obtained consistent with reliability. The speed of this development was necessarily restricted by the physical limitations of metallurgy and design at that time although, thanks to progress in this field, steam turbines of proven reliability were being manufactured in ever increasing sizes, and higher pressures and temperatures could be adopted with confidence.

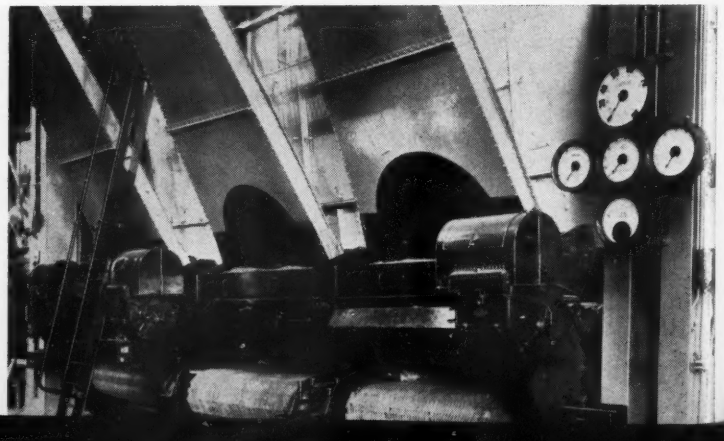
Enforced Efficiency

Coal prices steadily and rapidly increased after the second world war, making the attainment of yet higher thermal efficiency of even more paramount importance until, to-day, modern power stations can be expected to have an operating efficiency of about 30 per cent, whereas 24 per cent was considered a good achievement in 1939, and 12 per cent in 1920. In a recent issue of the magazine *Giant Power* it is mentioned that in 1920 a ton of coal could be expected to produce, on average, 640 kWh, whereas to-day a ton of coal should yield no less than 1,680 kWh. There seems little probability that coal prices will remain at their present level and still less likelihood that they will decrease. The attainment of even greater thermal efficiency now calls for the adoption of the maximum possible steam pressures and temperatures consistent with safety and reliability of operation.

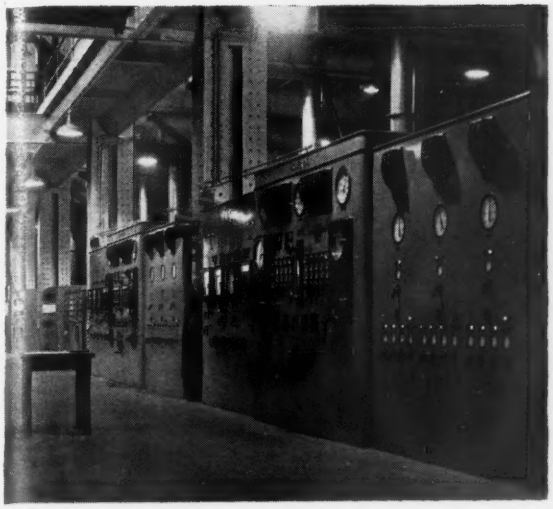
The progressive improvement of thermal efficiency and the rising cost of coal is well illustrated by the following examples of some of the fuel clauses which appeared in contracts governing supplies of electricity to industry. Between 1915 and 1925 a quite usual fuel clause in the South Wales Area specified an increase of 0·005d per kWh in respect of each 3d by which the price of fuel delivered at the power station concerned increased above 8s per ton, with proportionate adjustment should the calorific value of such fuel vary from 12,500 B.Th.U./lb. By the early 1930's the variant had become 0·006d per kWh in respect of each 6d, while the basic price of fuel had risen to 12s 6d per ton. After the second world war the figures had become 0·0008d per kWh in respect of each penny from 14s 6d per ton. Later this basic price became 30s and, later still until a year or two ago, 38s. The coal clause now applying for corresponding supplies of energy would range about 0·0007d per kWh in respect of each penny by which the cost of fuel exceeds 60s per ton. The foregoing trends of the price of coal, thermal efficiency, and pounds of coal consumed per kWh generated are illustrated in the accompanying graph, which shows the substantial increase in thermal efficiency



Above: The trends of price of coal, thermal efficiency and pounds of coal consumed per kWh generated



Right: The Upper Boat power station boiler house was initially equipped with hand-fired boilers but was later converted to chain grate stoker firing



Modern boiler house controls at the new Uskmouth power station

over the last thirty-five years; also the rapid increase of cost of coal since 1935, which could not be counteracted by further thermal efficiency advance, with the result that since 1935 the cost of fuel per kWh generated has steadily increased from about 0·12d, representing the lowest achieved, to a modern figure of about 0·45d.

There is, however, another factor in the coal industry which has had a profound influence on the electricity supply industry, particularly on power station design. It arises from the gradual perception and realisation of the intrinsic value of coal, i.e. the value of coal as a basic substance from which to derive not only a fuel but valuable chemical by-products as well. By the late 1930's it had become obvious that the electricity supply industry could no longer insist on high quality coal and, moreover, it was no longer in a position to choose the seams or collieries from which the coal should come. To obtain coal at what was then regarded as a reasonable price it was necessary to be content with small coal containing appreciable proportions of moisture and ash. To burn such coal efficiently called for new techniques, including that of pulverising which, in simple language, means blowing coal in finely powdered form and suitably mixed with pre-heated air into large combustion chambers, in lieu of the chain grate stokers which had, by then, become firmly established and which, in turn, had ousted the hand-fired furnaces of the early part of the century.

Power from Waste

The colliery companies themselves played a notable part in developing methods of utilising low-grade fuel, and, in some instances, particularly that of anthracite duff, they were the pioneers. After many initial difficulties and setbacks the Amalgamated Anthracite Collieries, Ltd., succeeded in burning such duff, both in a pulverised form at Aberpergwyn in the Vale of Neath and on chain grates at Great Mountain and Tumble Collieries. A similar success was also obtained by the Tareni Colliery Company at Pontardawe. In designing plant at the Tir John power station at Swansea, which burns anthracite duff, advantage was taken of the experience gained by the colliery companies mentioned. The production of low-grade fuel cannot be avoided at collieries, this being particularly true of anthracite duff, and it was naturally in the interests of colliery companies to develop methods of consuming it with reasonable efficiency since the knowledge gained made the fuel marketable. Even a few shillings obtained per ton of low-grade fuel was obviously better than incurring cost in dumping it as waste.

As a result of the difficulties created by the second world war there came a time when the position of the electricity supply industry as a consumer of coal reversed entirely from what it had been in the early part of the century. No longer could the power station engineer pick and choose. He was more likely to be found standing on the siding, gazing anxiously along the railway lines, and hoping that his urgent pleadings had been duly noted and that there would shortly appear a trainload of coal, of a type and quality suitable to his stoker plant, destined for his station. He would, in fact, be thankful to receive it.

Quality of coal has also been a factor in the placing of power stations. Ideally, a power station would be sited close to ample supplies of suitable coal, in proximity to sufficient cooling water and near to the centre of gravity of the electrical loads to be supplied, the site being such that civil engineering work could be kept to the minimum and with no difficulties on the score of public amenity. All these desirable factors are rarely realised in practice, the resulting choice of site being usually the best compromise available. When coal was cheap and of high quality, and rail freights were low by comparison with what they are to-day, there was much argument as to whether it was cheaper to transport energy in the form of coal to a power station placed close to the centre of its load or to generate near the source of coal and transmit the energy electrically over high-voltage lines. The position now with low quality coal is very different as it is obviously uneconomic to pay transport charges on the 20 per cent or so of ash which may be found in modern power station coal deliveries. The trend is therefore, on balance, to site power stations near to supplies of coal and to adopt high electrical pressures for transmitting the energy thus produced to the centres where it is required for consumption.

Patterns of Distribution

As mentioned earlier in this article, the coal industry has also had some influence on the distribution of electricity supply. This is certainly true of South Wales, but it may not be so apparent in other parts of the country. Among the principal industrial consumers of electricity in South Wales were the collieries themselves. They required what were then substantial supplies of high reliability and it was considered necessary, when dealing with colliery supplies, to construct at least two, sometimes three and, occasionally, four transmission lines to the colliery intake substation to ensure continuity of supply. Naturally, these substations became linked together until the pattern of the network formed a series of ring mains. These colliery supplies and, in some cases, also steelworks' supplies had the effect of bringing electricity into local authority areas previously without this service. It became the practice to deliver electricity in bulk to the local authorities for distribution by them to domestic and commercial consumers or, as not infrequently happened, the power company concerned itself took on the responsibility of such public service and low-voltage distribution. It would obviously not be true to say that, in all cases, public supplies followed the availability of bulk supply made possible because of industrial requirements; many of our large towns developed their own quite substantial generation and distribution systems, but there is no doubt that many local authorities were able to obtain bulk supply at reasonable prices because of the existence of a high-voltage network supplying collieries, steelworks and other major industries in their locality.

Future historians may possibly divide this century and

part of the last century into three stages; the first being the period of abundant, cheap, high quality coal, the second being a period of relatively dear, poor quality coal in which period we now find ourselves, while the third may be a stage when coal is no longer available in sufficient quantity to meet demands for power and must be supplemented by generation from oil or by nuclear energy. We may, in fact, now be entering on the opening scenes of some measure of divorce of the previous inseparable companionship of coal and power. We know that, because of the expectation that coal will not be available in sufficient quantities to meet future electricity demands, the Central Electricity Authority has arranged in its future programme for a proportion of electricity production to be obtained from oil firing in lieu of coal. This is not expected to have any marked effect on the resulting cost of electricity, but it is perhaps too early to make specific forecasts and, furthermore, the advent of nuclear energy will gradually make its mark until, by 1975, it is expected that one-fifth of the country's generation of energy will be by means of nuclear power. This, incidentally, will affect the future siting of power stations since nuclear power stations can, other considerations being satisfactory, be sited near to the centres of demand for electricity—as compared with the trend mentioned earlier of siting power stations near to the supply of coal. So far as can be forecast at the present time, it is not expected that the construction of nuclear stations will have any significant effect over the next twenty years on the cost of producing electricity.

It is possible that, by the end of the century, the divorce between coal and power will be more complete, and the writer of such an article as this might then commence by saying that the country relies for its power requirements—and thereby its very standard of living—on uranium, or whatever may be the material then used as the source of nuclear energy. It is quite clear, however, that for the present coal and power are inseparable and will remain so for many years ahead.

NEW BOOKS

Electronic Transformers and Circuits. Second edition. By Reuben Lee. Pp. 360; figs. John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 60s.

The author has aimed to provide a reference book for transformer designers, as well as a work showing the effect of transformer characteristics on electronic circuits. The latter aim, especially, has been well realised. As in many reference works, the effort to cover a large number of topics has resulted in somewhat brief treatment in a few places. Space devoted to ferrites, powdered cores and to transformers for transistor circuits might well be expanded in future editions.

The book starts, logically, with principles of leakage-free transformers for low frequencies, and then goes on to construction materials and ratings. Insulation, impregnation, heat dissipation and transformer testing, including corona tests, are discussed. More extensive tabulation of core material properties might have been helpful.

Requirements for small rectifier transformers (up to 3 kVA) are stated, and useful design charts for transformers on grain-oriented silicon steel "C" cores are included. Design of chokes carrying direct current is considered. Power supply filters form the subject of the next chapter. Choke and capacitance input filters are discussed and computations for regulation and ripple are presented. The computations are based on impedance ratios rather than on filter theory, which is mentioned in a later chapter.

Audio-frequency transformers are considered in Chapters 5 and 6. Starting with simplified explanations of thermionic triodes, the author proceeds to an examination of amplifiers of classes A, AB, B and C and to impedance matching. A digression is made to distributed-constant transmission lines to explain the use of matching transformers. Frequency response is examined with the aid of equivalent circuits, response curves are plotted for various parameters and effects of degenerative feedback are stated. In the same chapter there is a section on filter coils, including a useful graph of circuit magnification against frequency, with air gap as a parameter. This section might well be extended in a future edition.

Chapter 8 deals with thyratron control circuits, while magnetic amplifiers form the subject of Chapter 9. Following consideration of characteristic curves and load lines, the author proceeds to d.c. current transformers, to self-excitation and to the Ramey half-wave amplifier.

The rest of the book is devoted to high frequency applications. Surprisingly, wave windings are not considered in detail. The work on video and pulse transformers is well presented and leads, of course, to the criteria for minimisation of pulse rise time and tilt. A specimen calculation for a pulse transformer is included. Pulse permeability is briefly discussed, but no mention is found of the "hyperthin" metallic core materials now finding uses at very high frequencies.—G.M.E.

Electronic Measurements and Measuring Instruments. By F. G. Spreadbury. Pp. 459; figs. Constable & Co., Ltd., 10, Orange Street, W.C.2. Price 50s.

The field of electronic measurements has expanded so rapidly since the end of the war that, at the present time, electronic instruments are regarded as indispensable tools in many industries. For example, the progress made in nuclear physics would not have been possible without the aid of electronic control and measuring devices. It is clearly impossible to cover all the many varied aspects of the design and application of electronic instruments in a single book, but a survey of existing instruments shows that, in spite of the diverse functions performed, the basic principles of most instruments may be classified in a simple manner. Thus a valve-voltmeter, a pH meter and an electronic megohmmeter are all basically voltage measuring devices, and consequently they have many common features although the scale calibrations are entirely different.

Given an appreciation of the basic principles of the measurement of the common electrical quantities and a knowledge of the limitations of electronic components a detailed description of individual circuit designs becomes unnecessary.

Mr. Spreadbury's book opens with a lucid chapter on valves and components and then deals with the measurement of voltage, current and frequency. Further chapters are devoted to cathode ray tubes, oscilloscopes and subsidiary apparatus.

In the reviewer's opinion, the value of the book would have been enhanced if the author had described the features of some of the many excellent commercial instrument designs instead of relying almost exclusively on his own. For example, many manufacturers now supply oscilloscopes incorporating triggered time bases having accurate time scales and with calibrators for direct voltage measurement. These facilities are very valuable and should have been discussed.

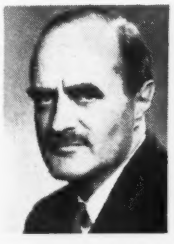
Similarly in the section on "Differential Voltmeters" one would have expected that the "long tailed pair" would have been mentioned, and surely that most versatile instrument, the "Q" meter, merits a reasonably detailed treatment in any treatise on electronic measurements.—H.B.W.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

At the annual general meeting of the British Standards Institution in London on 4th September a move was made to "streamline" B.S.I.'s organisation by combining the two formerly separate offices of president and chairman of the General Council. **Sir Herbert Manzoni** (city engineer, Birmingham), who is already chairman of Council, was elected the first president under this new arrangement. He succeeds **Sir Roger Duncalfe,** chairman of British Glues & Chemicals, Ltd. **Mr. John Ryan** (vice-chairman of the Metal Box Co., Ltd.) was re-elected vice-president.

Sir Harold Bishop, C.B.E., F.C.G.I., B.Sc.(Eng.), M.I.E.E., M.I.Mech.E., has accepted the invitation of the Executive Council of the Association of Supervising Electrical Engineers to become president in succession to **Mr. Bryan Donkin,** B.A.(Cantab.), M.I.E.E., who is retiring after two years in office. Mr. Donkin will introduce the new president at the first meeting of the London National Lecture session to be held at the Institution of Electrical Engineers on 16th October.



Sir Harold Bishop

Sir Harold was educated at Alleyn's School and, after a period of apprenticeship with a London firm, went to the City and Guilds College, South Kensington. He joined H.M. Office of Works in 1920, and in 1922 became a junior engineer in the Chelmsford Works of Marconi's Wireless Telegraph Co., Ltd. He transferred to the newly-formed B.B.C. early in 1923 and soon after was made senior superintendent engineer. In 1929 he was appointed assistant chief engineer under Sir Noel Ashbridge, and became chief engineer in 1943. On Sir Noel's retirement in 1952 he became director of technical services and just recently his title was changed to director of engineering. Sir Harold was chairman of the Radio Section of the Institution of Electrical Engineers in 1941-42, a member of Council from 1944 to 1947, vice-president from 1948 to 1943 and was president for the Session 1953-54.

Mr. J. G. Park, M.I.E.E., electrical engineering adviser to the Government of Ceylon, has been asked by the Minister of Transport and Works to review the organisation of the electricity supply industry in Ceylon and make recommendations for the future development of electricity in the Island.

Mr. D. R. Colvin has been appointed by Lanark County Council as county lighting engineer in succession to the late Mr. D. Lawson. Mr. Colvin has been deputy county lighting engineer since 1950. Before joining the County Council staff as assistant county lighting engineer in 1947, he was mains engineer with the former Hamilton Electricity Department. During the last war he held a commission in the R.A.F. (technical branch) and is at present a flight-lieutenant in the training branch of the R.A.F.V.R.

The Metropolitan-Vickers Electrical Co., Ltd., announces that the Contracts Department has ceased to be a separate department. With few exceptions, its work is now handled by the Plant Sales Department. As a consequence of this change, **Mr. F. L. Field** has been appointed assistant, sales management, and **Mr. J. Cannell,** B.Eng., A.M.I.E.E., has been appointed assistant to the sales manager, Plant Department.

Mr. Field joined M-V as a school apprentice in 1926 and on completing his course joined the Mechanical Department as assistant production engineer. In 1935 he transferred to the sales side, and ten years later he was appointed assistant to the sales manager, Mechanical Department. After a period as M-V liaison officer with the Ministry of Supply, he was appointed assistant manager, Contracts Department, and he has been manager of that department since 1951. Mr. Field is a member of the B.E.A.M.A. Contracts Conditions Committee.

Mr. Cannell received his technical education at Liverpool University and joined M-V as a college apprentice in 1939. From 1940 to 1945 he was with the projector section working on searchlights, sound locators, and the early airborne radar equipment. He then joined the Special Contracts Department handling various Admiralty contracts. After six years he transferred to the Contracts Department, where he has been assistant to the manager since June, 1951.

Mr. F. L. Field

Mr. J. Cannell

Mr. W. B. Laing, M.I.E.E., general manager of Bruce Peebles & Co., Ltd., Edinburgh, has been appointed managing director. Educated at Hawick High School, Mr. Laing in 1922 took his diploma in electrical engineering at the Heriot-Watt College, Edinburgh, of which he is an Honorary Fellow. Serving his apprenticeship with Bruce Peebles & Co., Ltd., he rose to become joint general manager in 1952 and in the same year was appointed a director. He has been chairman of the South-East Scotland Sub-Centre of the Institution of Electrical Engineers during the past session and is a past-president of the Edinburgh Electrical Society. In his new post he succeeds the late Mr. J. W. Rodger, M.I.E.E.

Mr. W. B. Laing

Lord Reith has been appointed a director of the British Oxygen Co., Ltd.

Mr. G. S. Helme, T.D., who has been actively associated with Lancashire Dynamo for over fifty years, was the guest of honour at a cocktail party on 5th September at the Central Hotel, Glasgow, to mark his retirement from the company. Educated at the Royal Salford Technical Institute and the Royal Technical College, Glasgow, Mr. Helme joined the Trafford Park Works of Lancashire Dynamo & Crypto, Ltd., as an apprentice in 1906. By arrangement with the company, he commenced his training at Hick Hargreaves & Co., Ltd., and in 1909 he went to Glasgow where for five years he was a partner of Kelsall Parsons & Co., at that time agents in Scotland for L.D.C. Mr. Helme was appointed manager in Scotland for L.D.C. in 1932—a position which he held for 21 years—and since 1953 the company had retained his services in a consultative capacity.

Mr. G. S. Helme

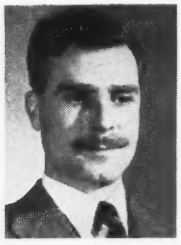
Throughout the last war Mr. Helme served as a representative of the D.I.E.E. in Scotland and is at the

present time a member of the Electricity Consultative Council for the South of Scotland District. He has also recently been appointed a director of the Glasgow Chamber of Commerce.

The cocktail party was attended by a distinguished gathering of representatives of many large Scottish engineering concerns, and the South of Scotland Electricity Board, and by personal and business friends. Mr. W. J. A. Gemmell, who succeeds Mr. Helme as Scottish manager, received the guests. Mr. E. Dick-Cleland handed Mr. Helme a cheque on behalf of the company and Mr. E. H. Schroeder, sales director, presented him with a certificate of his 50 years' service.

Mr. Helme briefly replied and Mr. R. Lamont, on behalf of the guests, expressed the pleasure of all present at the gesture of recognition of Mr. Helme's service. Mr. Helme had had the difficult task of reconciling his company's interests and those of his customers and the success he had achieved in this sphere was emphasised by the attendance of so many friends.

Mr. F. E. Stevens has been appointed sales engineer with Wilec, Ltd., electrical wholesalers. He served his apprenticeship with Johnson & Phillips, Ltd., and until recently was with the China Engineers, Ltd., in Singapore, in the capacity of contract engineer.



Mr. F. E. Stevens

Mr. D. S. Bennett has relinquished his position as managing director and resigned from the board of Tyer & Co., Ltd., Dalston, E.8, manufacturers of railway signalling equipment, a subsidiary of Southern Areas Electric Corporation, Ltd. He is succeeded as managing director of Tyer & Co. by **Mr. S. R. Elliott.**

Dr. B. Salvage, B.Sc.(Eng.), A.M.I.E.E., who is the co-author with **Mr. E. A. Smith,** Associate I.E.E., of the article on "Impulse Testing of High-Voltage Cables" appearing in this issue, was educated at Queen Mary College, London University, where he was a College Science Exhibitioner. He graduated in 1943 and was subsequently employed at the Admiralty Research Laboratory, becoming a member of the Royal Naval Scientific Service on its formation. In 1946 he returned to Queen Mary College where he undertook research on the breakdown of liquid dielectrics for which he was awarded the Ph.D. degree. Dr. Salvage joined W. T. Henley's Telegraph Works Co., Ltd., in 1949 and, since 1951, he has been in charge of their High-Voltage Research Laboratory.

Mr. Smith has worked in Henley's Research Department since 1929, having previously completed an apprenticeship. He has been mainly concerned with the testing of high-voltage cables and accessories and has been responsible for the design of specialised apparatus for this work. Mr. Smith has been closely associated with the development of pressure cables and recently with the 132 kV, three-core oil-filled cable now being marketed by Henley's.

Dr. B. Salvage

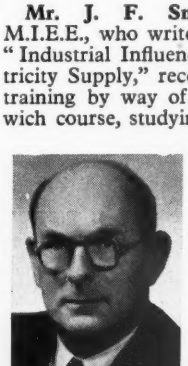
Mr. E. A. Smith

The 10th examination held under the Diploma Scheme of the **Association of Supervising Electrical Engineers** was held at London and Manchester Centres during May. The following candidates were successful and have been awarded the appropriate diploma or certificate endorsed with the specialist subject in which the examination was set:—

A.S.E.E. Diploma.—Electrical Installation Practice: F. Crossley (Radcliffe, nr. Manchester); R. E. Elmes (Bayswater, London); J. S. Eynon (Burghfield, nr. Reading); and N. Whittle (Preston). Electrical Maintenance: J. Ainsworth (Blackburn) and H. Twemlow (Nottingham).

A.S.E.E. Technician's Certificate.—Specialist Section—Installation Work: N. English (Paignton) and E. J. Ware (Romford, Essex). Specialist Section—Maintenance Work: N. English (Paignton); I. McL. Ireland (Upper Largo, Fife); J. S. Low (Coningsby, Lincs.); A. J. Rice (Peckham, London); and G. A. Tayler (Banbury, Oxford). Specialist Section—Design and Layout: E. F. Cooper (Twickenham, Middx.); and C. Pooley (Wednesfield).

Mr. J. F. Smith, B.Sc.(Eng.), M.I.E.E., who writes in this issue on "Industrial Influence on Public Electricity Supply," received his technical training by way of a five-year sandwich course, studying for one year at the University of Wales, followed by four years at the South Wales and Monmouth School of Mines concurrently with five years' practical training at the Penrikyber Navigation Colliery. From 1924 to 1927 he was technical assistant to the chief electrical engineer of the Powell Duffryn Steam Coal Co., Ltd., and was engaged mainly on colliery electrification and ventilation. During the following four years he was chief technical assistant to Messrs. Kane & David, consulting mechanical, electrical and mining engineers to steelworks, collieries and other industries. In 1931 Mr. Smith was appointed consumers' engineer (industrial business) to the South Wales Electric Power Co., being also engaged on special developments, including tariff design, steam supply, industrial and power station sites, etc. Since 1948 he has been chief commercial officer of the South Wales Electricity Board.

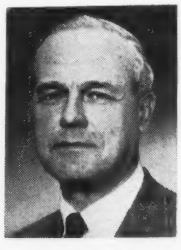


Mr. J. F. Smith

Mr. A. J. Brunker, B.Sc. (Eng.), A.C.G.I., D.I.C., A.M.I.E.E., chief engineer of E. K. Cole, Ltd., has been appointed an executive director of the company. Since joining E. K. Cole, Ltd., in 1947, Mr. Brunker has successively held the positions of general export manager and chief engineer and in 1953 he was appointed a director and general manager of Ekco Electronics, Ltd., the wholly-owned subsidiary of E. K. Cole, Ltd. He joined the company from the Ministry of Supply, where, for several years, he held the post of deputy director, radio production.

Mr. A. J. Brunker

Mr. A. Whitaker, O.B.E., M.A., M.I.E.E., F.Inst.P., has been appointed a director of Siemens - Ediswan, Ltd. He is director of engineering covering the Edison Swan interests of the company and his headquarters are at Cosmos Works, Brimsdown, Middlesex. Originally a physicist (1st Class Physics Hons., Cambridge) with research experience in interior ballistics on aluminium production, Mr. Whitaker joined the Gramophone Co. (H.M.V.) in 1927 to initiate a research department. Subsequently in charge of product engineering for H.M.V. in the production of domestic appliances and cathode ray tubes, he became during the war chief engineer of the Parnall group of companies, designing aircraft armament, tank armament and radar. Later he became chief engineer of Ascot Gas Water-Heaters. He has served on the committees of the Gas Research Board, the Council of Industrial Design and the Royal College of Art.



Mr. A. Whitaker

In addition to the appointments announced in our last issue, the English Electric Valve Co., Ltd., has appointed **Mr. R. H. Deighton** to the newly formed post of commercial manager. Before joining the company Mr. Deighton served for twenty-six years with Marconi's Wireless Telegraph Co., Ltd., and held posts both in the engineering and sales sides of the company. During the war he was responsible for organising the supply and erection of direction finding stations for the armed services, and since the war he has been particularly associated with aeronautical and maritime activities of the company. In 1954 he was appointed manager of Marconi's central division and became responsible for the erection of masts and towers and for the production and sale of valves and crystals.

Mr. R. H. Deighton

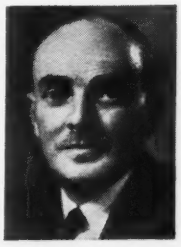
Mr. L. Drucquer, M.I.E.E., has been appointed a director of the British Thomson-Houston Co., Ltd., with special responsibility for home sales. Mr. Drucquer joined the B.T.H. Co. in 1920 in the Testing Department, Rugby, after gaining his engineering diploma at London Polytechnic. Subsequently he had two years on the outside construction staff before taking up an appointment in the Switchgear Contracts Department, Willesden, in 1925. He became assistant manager of this department in 1939 and manager in January, 1945. Since October, 1950, he has been manager, home sales. He has been an active member of the Institution of Electrical Engineers for many years; he is a member of the Council and was chairman of the Supply Section for the 1955-56 session. Mr. Drucquer is also a director of the Switchgear Testing Co., Manchester.

Mr. L. Drucquer

Mr. F. R. W. Strafford, M.I.E.E., has resigned from Belling & Lee, Ltd., with whom he has served for many years as technical manager, to become a consulting radio and electronic engineer on his own account.

Mr. B. H. Douthwaite, A.M.I.E.E., is joining Belling & Lee with effect from 1st October, taking up the appointment of administrative head of the research and development activities of the company. Amongst his various appointments since entering the radio industry through the G.E.C. Laboratories, Mr. Douthwaite was previously with Belling-Lee from 1945 to 1947 and was subsequently a divisional manager at the research laboratories of Elliott Bros. (London), Ltd.

Professor Willis Jackson, director of research and education, Metropolitan-Vickers Electrical Co., Ltd., has been appointed chairman of a Joint Committee set up to advise Sir David Eccles, Minister of Education, upon the recruitment and training of teachers for technical colleges. Members of the Committee have been nominated by the chairman of the National Advisory Council on the Training and Supply of Teachers and the chairman of the National Advisory Council on Education for Industry and Commerce.



Prof. Willis Jackson

Mr. Leslie Gamage, the president, took the chair at last Tuesday's luncheon of the **Electrical Industries Club** at the Connaught Rooms, London. He announced that at the next luncheon (9th October) the guest-speaker would be Sir John Maud, Permanent Secretary to the Ministry of Fuel and Power. He also said that a Club golf meeting would be held at Woodcote Park, Epsom, on 17th October. Mr. Gamage then introduced the day's speaker, Mr. Frank Owen, the well-known journalist, who gave a most informative, interesting and, at times, amusing account of his recent visit to the Middle East. A large part of the address dealt with the Suez Canal question and Mr. Owen's interview with Colonel Nasser. Mr. H. S. Pocock proposed the vote of thanks to Mr. Owen.

OBITUARY

Brig.-General Wade Hampton Hayes, O.B.E., chairman of Edmundsons Electric Co., Ltd., and chairman or director of associated companies, died on 4th September whilst on a visit from London to his family at Chappaqua, New York State; he was seventy-seven years of age. Brig.-General Hayes was also a director of the English Electric Co., Ltd., D. Napier & Son, Ltd., Marconi's Wireless Telegraph Co., Ltd., and associated companies.

The late Brig.-Gen. Wade Hayes

Born in Norfolk, Virginia, U.S.A., he was educated at Norfolk Academy, Va., and Columbia University. He served in the Spanish-American war in 1898 and from 1908 to 1914 he was Sunday editor of the *New York Tribune.* During the 1914-18 war he served with the American Expeditionary Force as a lieutenant-colonel on the staff of General Pershing. He retired from the American Army with the rank of brigadier-general. Brig.-General Hayes came to London in 1926 as European representative of the banking concern, Chase Securities Corporation. Later he joined the Edmundsons group of electricity supply companies which had become the property of a utility operator in Chicago. During the fifteen years until the nationalisation of the industry in 1948, Brig.-General Hayes built the group of companies into one of the largest groups in the electricity supply industry and he restored British control.

Sir Ralph Wedgwood, Bt., C.B., C.M.G., for many years chief general manager of the London & North Eastern Railway, died at his home near Dorking on 5th September at the age of eighty-two. Sir Ralph was a member of the Weir Committee on Main-line Railway Electrification (1930-31) and he was on the Central Electricity Board from 1931 to 1946.

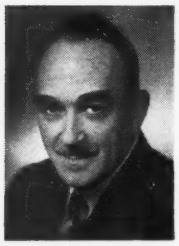
HOUSE HEATING

The British Electrical and Allied Manufacturers' Association is holding a Press conference at Gunter's Restaurant, Curzon Street, London, W.1, on Wednesday next, 19th September. The theme will be "The Best Way to Heat Your House this Winter." Arrangements for the conference are being made by Editorial Services, Ltd., public relations advisers to the B.E.A.M.A.

PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £197 0s 0d
COPPER, H.C. Electro	ton £307 10s 0d
Fire Refined 99·70%	ton £306 0s 0d
Fire Refined 99·50%	ton £305 0s 0d
COPPER Tubes ..	lb 2s 11½d
Sheet	ton £379 5s 0d
H.C. wire and strip ..	ton £340 5s 0d
LEAD, English ..	ton £117 15s 0d
Foreign	ton £116 0s 0d
MERCURY	flask £83 10s 0d
TIN, block (English) ..	ton £777 10s 0d
ZINC, G.O.B. Foreign	ton £96 5s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 2s 5½d
Sheet	ton £305 5s 0d
Wire	lb 3s 0½d
PHOSPHOR BRONZE Wire	lb 4s 6½d
PLATINUM	oz £34 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 28d—28¼d



Left to Right:
Dr. D. Taylor
Dr. R. C. G. Williams
Mr. P. J. Ryle
Mr. H. J. Gibson

I.E.E. Specialised Sections

NOTES ON THE CHAIRMEN FOR 1956-57

THE London meetings of the Institution of Electrical Engineers for the 1956-57 Session open on 4th October with the presidential address by Sir Gordon Radley. An outline of Sir Gordon's career was given in our issue of 20th July, and following our customary practice, we give below biographical notes, together with the portraits, of the chairmen of the specialised Sections of the Institution. We propose to publish particulars and portraits of the men who will preside over the activities of the provincial Centres in following issues.

Mr. D. Taylor, M.Sc., Ph.D. (Measurement and Control Section), was born in 1910 and was educated at the Riley High School, Hull. He graduated with the degree of B.Sc. in the University of London in 1932 and subsequently obtained the degrees of M.Sc. (in electromagnetic theory) and Ph.D. in physics. Between 1931 and 1939 he held a number of lectureships in electrical engineering and physics and in 1939 he joined the Air Ministry as a scientific officer and subsequently played a leading part in the development of radar at the Telecommunications Research Establishment, where he held an appointment as superintendent. In 1944 he went to the Far East in charge of a radar development unit to assist the R.A.F. and the Fleet Air Arm. In 1945, after the termination of hostilities, he returned to the Telecommunications Research Establishment and took up his present position as head of the Electronic and Instrument Division, Atomic Energy Research Establishment, Harwell. Dr. Taylor is the author of many scientific papers on radar, aerial systems, nuclear instruments and reactor control, as well as a number of books.

Mr. R. C. G. Williams, Ph.D., B.Sc.(Eng.), A.C.G.I., D.I.C. (Radio and Telecommunication Section), is chief engineer with Philips Electrical, Ltd. He received his education at the Westminster City School and the City and Guilds (Engineering) College, and at the latter college was demonstrator from 1929 to 1931. From 1931 to 1944 he was with Murphy Radio, Ltd., first as production manager and chief engineer (1931-1944) and then as general manager of the electronics division. In 1946 he went to New York as executive engineer with the North American Philips, Inc. He returned to this country to take up his present position with Philips Electrical, Ltd., in 1948. Dr. Williams is the author of a number of I.E.E. papers on electronics subjects, and among his Institution activities he was a member of the I.E.E. Committee on Practical Training for Engineers from 1944 to 1946. He is a member of the Institution of Mechanical Engineers and the Royal Institution, a Fellow of the Physical Society, the Royal Society of Arts and of the American Institute of Electrical Engineers; he is also a member of the American Society of Mechanical Engineers and a senior member of the American Institute of Radio Engineers. He was a member of the Engineering Study Group of the O.E.E.C. which visited the United States under the Mutual Security Agency in 1952. Dr. Williams is a Liveryman of the Clothworkers' Company, a Freeman of the City of London, and a member of the Pilgrims.

Mr. P. J. Ryle, B.Sc.(Eng.) (Supply Section), was educated at Brighton College, Brighton Municipal Technical College, and University College, London. In the 1914-18 war he served first as a private in the Royal Fusiliers and later as a lieutenant in the R.G.A., being mentioned in despatches. His early training and experience were received with Vickers, Ltd., the Metropolitan-Vickers Electrical Co., Ltd., Twiss Electric Transmission, Ltd., and the British Electric Transformer Co., Ltd. Since 1924 he has been with Merz & McLellan, consulting engineers, and for many years has been chief transmission line engineer with the firm. Mr. Ryle is the author of two I.E.E. papers (both of which were awarded premiums) and of four C.I.G.R.E. papers. He is a member of many E.R.A., B.S.I., and C.I.G.R.E. Committees and served as chairman of the North-Eastern Centre of the I.E.E. for 1950-51.

Mr. H. J. Gibson, B.Sc.(Hons.), A.C.G.I. (Utilisation Section), has been chief commercial officer of the Midlands Electricity Board since nationalisation in 1948. He was educated at the City and Guilds Engineering College and received his training at H.M. Dockyard, Sheerness. From 1923 to 1930 he was assistant electrical engineer with the British Electrical Federation, following which he was with the Shropshire, Worcestershire & Staffordshire Electric Power Co. until nationalisation. During that period he held the appointments of assistant engineer, Distribution Department (1930-1935), deputy distribution engineer (1936-1940), manager, Central Division (1940-1945), and finally (1946-1948) commercial manager. He is a past-chairman of the South Midland Centre of the I.E.E. and was a member of the I.E.E. Council representing the South Midland Centre from 1953 to 1955. He is an associate member of the American Institute of Electrical Engineers.

Film Presentation

The British Kinematograph Society is holding a course of five lectures on 16 mm film presentation at the Lighting Service Bureau, 2, Savoy Hill, London, W.C.2. The lectures will be given on Fridays (7 p.m.) commencing on 12th October. The charge for the course will be £1 1s for members of the B.K.S. and £2 2s for non-members. Application should be made to the secretary of the Society, 164, Shaftesbury Avenue, London, W.C.2.

VIEWS on the NEWS

By REFLECTOR

THE "Do it Yourself" movement is making headway but not always in the right direction. A correspondent to *Everywoman* has drawn attention to the economy achieved by a friend of hers by making her own electric blanket; the friend has told the correspondent where to buy the wiring and the question is put: "Do you think it would be safe?" Wisely, the journal tackled the British Electrical Development Association on the subject and, naturally, E.D.A. replied that the home-made blanket could not be too strongly condemned. This reply is appended to the reader's letter. I am glad to see that E.D.A.'s educational activities are bearing fruit. In the past the popular Press has been too prone to encourage readers to do things which were better left to the "professionals."

* * *

At about this time last year I protested against the omission of any mention of the man responsible for the Blackpool illuminations in the B.B.C.'s television programme on the occasion of the switching-on ceremony. Whether this had any influence or not I do not know but at any rate in this year's commentary Mr. Richard Dimbleby paid a compliment to Mr. Carpenter as the "architect and designer" of the illuminations. Mr. Carpenter is this year's president of the Association of Public Lighting Engineers whose annual conference is being held at Blackpool next week.

* * *

Some notes on the construction of the Eiffel Tower appear in the latest issue of "The Brook," the little magazine published by Brook Motors, Ltd. In the course of these it is said that "if the seven million rivet holes were joined end to end the tube would be 43 miles long." Of course it wouldn't be worth doing (quite apart from the effect on the structure) for nobody would see them.

* * *

I have occasionally mentioned the lapses of British firms in their advertising in foreign newspapers. The subject is referred to by Mr. Henry Deschampsneufs in an article which he has contributed to the *Board of Trade Journal*. Instances are quoted of an advertiser who inserted an advertisement in Arabic in a Persian publication and another who employed in Venezuela a picture of a typical English winter scene. The writer stresses the importance of adapting advertising to the prospective customers. In announcing a new product, he says,

> "In the United States, conditioned as Americans are to hard-hitting and hard-selling statements, it would probably be done with screaming headlines, bold type—success and 'news value' in every word. In Sweden, on the other hand, a more restrained way, with more thoughtful reasons given for buying the product, would be preferable. In the Far East—for, say, a Chinese audience—it might be better to announce in a humble and even somewhat apologetic manner."

I rather wish the author had given an example of what he considered to be an appropriate advertisement for a Chinese newspaper. Might not such an approach meet with what Kai Lung termed "a certain measure of no enthusiasm."

Somewhat related to this subject is the question of the use of English by (normally) non-English-speaking nations. In medieval times Latin was the *lingua franca* of the Western world and beyond. If the necessity for a common tongue was recognised then how much greater should that recognition be now. I was pleased to see that Mr. Nehru recently urged his compatriots to continue to learn English because he considered it to be the most important language in the world. He said it was the unifying language in India and was particularly important for scientists. Most countries in which the English and Americans have had influence have benefited from the use of English but nationalism has led them to attempt to eschew it. Perhaps they will have second thoughts on the subject after Mr. Nehru's statement.

* * *

In New York in November the Third International Automation Exposition is being held and it is being "put over" with the customary American *élan*. I have received a copy of a proclamation made by Mr. Robert F. Wagner, Mayor of the City of New York, declaring 26th to 30th November "Automation Week." This document opens with a number of "whereases" one of which is to the effect that automation has

> "achieved recognition as the principal material means of attaining the more productive and enjoyable life all men seek and offers America and the world the most practical means of abolishing that mental and physical drudgery which deadens appreciation of the finer things of life."

The Mayor concludes by urging his fellow citizens and visitors to "take heed so that maximum advantages will accrue to us all and that there will be greater security and comfort in the world of the future." He could hardly say more than that.

* * *

The *Electrical Review* of 15th September, 1876, recorded the following alarming incident:—

> "A curious electrical effect was observed by M. Trécul during a thunderstorm on the 18th ult. He was writing at his open window at the time. When the thunder seemed nearest, some small luminous columns descended on the paper; one was about 2 metres long, and 0·15 metres wide at the widest part. Obtuse at the further end, they gradually thinned to 3 or 4 centimetres at the surface of the table. Their appearance was that of inflamed gas with ill-defined contour; their general colour, not intense, was yellow, slightly reddish, but at the paper surface the tints were more lively. In being extinguished, they left the paper with a slight noise (or *bruissement*, the first syllables of which word, M. Trécul says, somewhat imitate the sound)."

Automation Prospects

IN May last the Department of Scientific and Industrial Research issued "Automation: A Report on the Technical Trends and their Impact on Management and Labour" (H.M. Stationery Office, 6s). Because of its length and technical nature it was thought to be unsuitable for the "ordinary" reader and so the D.S.I.R. has produced a shortened and simplified version under the title "Automation in Perspective" (H.M.S.O., 1s 6d).

This 28-page booklet defines and describes automation, illustrates examples of transfer machines, and assesses the prospects of fully-automatic factories. From this it considers how far and how fast automation can go and in what industries it may or may not be introduced. It is shown that such processes need not be confined to large works and the finance of the subject is briefly touched upon. In studying the effects of automation upon managerial functions the booklet states that it will make production more complex, plants will become inflexible and the share of machinery in the total costs of production will be increased. All this postulates the need for a high degree of planning and control; new management techniques; and changes in the structure of management, favouring the advancement of scientists and technologists.

From the employees' point of view the effect of automation would appear to be the creation of "redundancy." It is shown that this need not occur if the rate of change-over is regulated and if training schemes are introduced well in advance of the need. Stress is laid on the need for consultation between managements and the trade unions. It is considered that automation will increase the demand for skill and raise the standard of work.

An appendix sets out a list of training courses relevant to automation which are available in universities and technical colleges in England and Wales.

I.E.E. Supply Section Visit

ON 8th September, over 100 members of the Supply Section of the Institution of Electrical Engineers with their ladies, visited the British Thomson-Houston Co.'s new turbine works at Larne in Northern Ireland. The visitors, who were welcomed by Mr. D. R. S. Turner (manager, Larne Works) supported by Mr. W. S. Steel (sales director, B.T.H.), included Mr. L. Drucquer (chairman of Section), Major E. N. Cunliffe (chairman, Northern Ireland Centre I.E.E.), Mr. P. J. Ryle (chairman elect, Supply Section), Mr. S. E. Goodall (vice-president I.E.E.), Sir John Hacking (past president), Mr. J. D. Peattie (past chairman, Supply Section) and Mr. J. R. Beard, C.B.E. (past president I.E.E.). The morning was spent touring the new factory buildings nearing completion, as well as the turbine blading factory now in production. The new works are to be devoted exclusively to the manufacture of steam turbo-alternators of 30 MW and upwards. The works will ultimately employ 3,000 people. The turbine factory, 850ft long and 425ft wide, is split into seven bays, the highest being 101ft above ground level. Buildings already erected and occupied since operations commenced on the site in January, 1954, are the blading factory, transport garage, employment bureau, gate house, and canteen. The power house, cooling tower, gas producer plant, and fire and ambulance stations are expected to be completed by early 1957.

Technical Information Services

THE London and Home Counties Regional Advisory Council for Higher Technological Education has published a booklet (price 1s) on "Technical Information Services to Commerce and Industry."

Early in 1955 the Steering Committee of the Regional Academic Board asked the Librarianship Committee for advice on the feasibility of co-operation between county and municipal libraries and libraries in technical colleges, industrial firms and research asociations in a given area to provide a scientific and technical information service which would be available to all local industrial and commercial concerns. Since that time the Committee has examined schemes in operation, or planned, in the London and Home Counties region and in other parts of the country. The booklet gives details of these schemes and the Committe's recommendations for their further development. Copies of the booklet can be obtained from the Regional Advisory Council at Tavistock House South, Tavistock Square, London, W.C.1.

New Automatic Telephone Exchange

THE General Post Office has awarded to Standard Telephones & Cables, Ltd., the contract for the manufacture and installation of a new automatic telephone exchange at St. Albans, Hertfordshire. The automatic telephone equipment, of the G.P.O. "Non-Director" type and with a capacity for 8,500 subscribers' lines, will be extended ultimately to about 16,000 lines, which is an exceptional size. The associated manual switchboard, of 40 operators' positions, will cater for incoming and outgoing telephone traffic which cannot be dialled. In addition, there will be six inquiry positions.

The manual board at the St. Albans exchange will also be the manual board for the automatic telephone exchanges to Bowmansgreen, Colney Heath, Park Street, Redbourn and Wheathampstead, and will handle the incoming and outgoing traffic of these exchanges which cannot be dialled, together with their inquiry calls.

The power plant comprises a duplicate battery scheme, each battery having a capacity of 3,000 Ah at 50 V, complete with ringers and motor generator sets.

All the subscribers on the St. Albans exchange will have dialling facilities to over 20 automatic exchanges in Hertfordshire, and many of the subscribers on the London "Director" exchanges will be able to dial direct into St. Albans by means of a predetermined code. The new building is in course of construction, and the automatic exchange is expected to be ready for service in 1959.

Letter to the Editor

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Technical Qualifications

IN your issue of 31st August "Senex" gives a very adequate summary of the present position. What is not realised by those who grant "status" in terms of being a chartered electrical engineer is that many Associate Members and, sometimes, Members, are not capable of running a department or taking a responsible position supervising the work of others. They may be adequately qualified for taking the responsibility for their own work and even hold qualifications in excess of those required for the job they are doing but they lack a managerial outlook and inclination.

A simple method of overcoming the frustration of which "Senex" writes is to give more weight to the Associate I.E.E., who has all the qualifications required for Associate Membership except that he lacks academic qualifications, i.e. the piece of paper. In view of the experience on the job which is necessary before one can become an Associate, could not a prescribed number of years in a responsible position in technical charge of others be considered as entitling an Associate to become a chartered electrical engineer?

"FORFOR."

INDUSTRIAL NEWS

Engineering Training in Russia

A British engineering delegation is to visit Soviet Russia this month to study engineering education and training. The nine members of the group were nominated by the Joint Committee of the Institutions of Civil, Mechanical and Electrical Engineers and the visit will take place under the auspices of the Soviet Relations Committee of the British Council. A return visit to the United Kingdom by a group of Soviet experts is under consideration. The group will leave London by air on 16th September, returning probably on 28th September. The programme in Russia will include visits to higher technical education establishments in Moscow and Leningrad. The group will be led by Professor E. Giffen, Professor of Civil and Mechanical Engineering in London University. Other members are: Mr. W. K. Brasher (secretary, Institution of Electrical Engineers); Dr. B. N. Cole (senior lecturer in Mechanical Engineering, Birmingham University); Mr. H. E. Dance (H.M. Inspector of Schools (Technical Branch)); Dr. H. L. Haslegrave (Principal, Loughborough College of Technology); Mr. G. S. C. Lucas (director and chief electrical engineer, British Thomson-Houston Co., Ltd., Rugby); Mr. P. E. Sleight (head of Civil Engineering Department, Brighton Technical College); Mr. E. G. Sterland (principal, Apprentices' School, the Bristol Aeroplane Co.); and Professor A. S. T. Thomson (head of the Department of Mechanical, Civil and Chemical Engineering, Royal Technical College, Glasgow).

Substation Switchgear Contract

The General Electric Co., Ltd., has received a contract from the Central Electricity Authority valued at £689,000 for an outdoor switching station to be erected near Wolverhampton. The new substation will include a 17-switch section for service at 132 kV and a 3-switch section operating at 275 kV. The contract covers the circuit-breakers, together with the associated air-break isolators and busbars, for both sections of the new substation. Separate contracts cover modifications to existing equipment at other substations in the vicinity.

Oil circuit-breakers with a breaking capacity of 3,500 MVA will be provided for the 132 kV section of the new substation. For the 275 kV section the breakers will be of the air-blast type with a rating of 7,500 MVA. At associated substations twenty-three G.E.C. oil circuit-breakers, which were installed as part of the original grid system, are to be modified to increase their breaking capacity from 1,500 MVA to 2,500 MVA. With the exception of the 275 kV circuit-breakers, the whole of the electrical equipment for the contract will be made at the company's Witton Works. The 275 kV breakers will be built by A. Reyrolle & Co., Ltd., under a sub-contract.

Grain Dryers in Demand

This year's harvest has been badly affected by the inclement weather of the past few weeks. It has been practicably impossible to gather in grain crops in a dry state and consequently there has been a run on grain dryers. The General Electric Co., Ltd., tells us that it is now selling more dryers a week than it normally sells in a month. Farmers have been calling at the company's stores in Union Street, London, S.E.1, to collect dryers at all hours of the day and night and have occasionally caused congestion there. One even hired a taxi, loaded a disassembled plant into it and drove away.

Leicester Domestic Exhibition

One of the most colourful and eye-catching displays amongst the 200 at the 25th East Midlands and Leicester Home Life Exhibition at the Granby Halls, Leicester (5th-15th September) is that of the East Midlands Electricity Board. Its theme is the "four foundations of modern living," and a large selection of cookers, water heaters, washing machines and refrigerators is being shown. One attraction is the "Dishlex" automatic dishwasher made by Scott Engineering (Newport), Ltd. This year the Board makes a special feature of automatic cooking, and the cookers shown are a selection by G.E.C., the Simplex Electric Co., Ltd., and Tricity Cookers, Ltd.

Three cooking and washing machine demonstrations have been given each day by the Board's own demonstrators, and by demonstrators from the companies co-operating in the display.

Motor Manufacture in India

A reader in Madras informs us that a group of Indian industrialists is interested in setting up in that city a factory for the production of electric motors. A capital of £100,000 is available and no overseas financial assistance is required. What is wanted is technical aid in setting up the factory and a manufacturing licence from a leading British manufacturer. We shall be pleased to give the name of our inquirer to interested British firms.

Transformers for T.V.A.

A contract for four 26,667 kVA, single-phase, forced-air-cooled, outdoor type transformers has been awarded to Ferranti, Ltd., by the Tennessee Valley Authority, United States. These transformers will form one 80,000 kVA 154/69/13·2 kV, 3-phase bank of transformers, the fourth transformer being a spare unit, and will be installed in the Pigeon Forge substation, Knoxville, Tennessee. This is the sixth order received by Ferranti, Ltd., from the United States in recent years and brings the total number of transformers supplied or under construction to 45 units of a total capacity of over 2 million kVA.

Instrument Maker's Showrooms

A newly constructed building in New Cavendish Street, London, W.1, now houses the new showrooms and offices of the Pullin group of companies. The premises, to be known as Electrin House, are of modern design and a distinctive feature is the facing of all frontages which is an aluminium framed curtain wall with "Vitroslab" panels and steel window inserts. The basement, ground floor and four upper storeys provide a total area of over 21,000 sq ft and all floors are served by an automatic lift.

In the 1,500 sq ft showroom on the ground floor a wide range of products of the Pullin group is displayed. This includes electronic and gyroscopic apparatus (R. B. Pullin & Co., Ltd.); electrical instruments, relays and test equipment (Measuring Instruments (Pullin), Ltd.); photographic apparatus and accessories (Pullin Optical Co., Ltd.); and medical and physiotherapy equipment (Stanley Cox, Ltd.).

Provision is also made in the showroom for lectures, demonstrations and film shows. Illuminated shop windows are built into the two ends of the main

Electrin House, the new London showrooms for the Pullin group of companies

frontage and a road transport loading bay is located at the rear. In the basement of the building is situated the stores, packing department and the sales counter of Stanley Cox, Ltd., and the Pullin Optical Co., Ltd. There is also a dark room to facilitate the servicing of loaded cameras.

The first floor houses the sales departments of the above-mentioned companies together with the administration of the building.

The architects were Gollins, Melvin, Ward & Partners, and the builders Griggs & Sons, Ltd. E. Pollard & Co., Ltd., were responsible for the showroom.

New Birmingham Lighting Showrooms

On Monday last a new A.E.I. Lamp & Lighting Company showroom was opened at the company's Midland Region headquarters at 26-28, Holloway Head, Birmingham, 1. As in the case of the company's London and Glasgow showrooms, the interior has been designed principally as a shell to accommodate lighting exhibitions. It has a floor area of 1,300 sq ft and is equipped with "Mazda" Invertrunking to ensure complete flexibility of lighting. Designed by Mr. R. Wetmore, M.I.S.A., in conjunction with Mr. L. Goodey, A.R.I.B.A., M.S.I.A., the showroom occupies a space which was originally a Metropolitan-Vickers showroom. It has been enlarged and, by taking in the old loading bay and an annexe behind the staircase, will become a permanent exhibition of lighting fittings. The frontage was completely redesigned and the floor of the showroom has now become level with the pavement. The windows are lit by recessed fluorescent fittings and eyeball spots.

The first exhibition in the new showroom is devoted to the development of electric lighting against a background of lighting through the ages. A collection of lamps is on show from early Phœnician lamps dated 1500 B.C. and these may be compared with a selection of the most recent incandescent and discharge lamps. An exhibit with individually switched sections demonstrates with simple examples the need for control which is necessary if light is to be used effectively. An individually switched colour comparison cabinet shows the difference between the colour rendering of light from a number of tungsten, mercury vapour and fluorescent lamps. A rotating sphere, lighted by yellow sodium light on one side and tungsten light filtered to the same colour on the other, dramatically illustrates the difference between colour appearance and colour rendering.

Mr. B. J. Robinson has been appointed regional publicity assistant for the Midland Region.

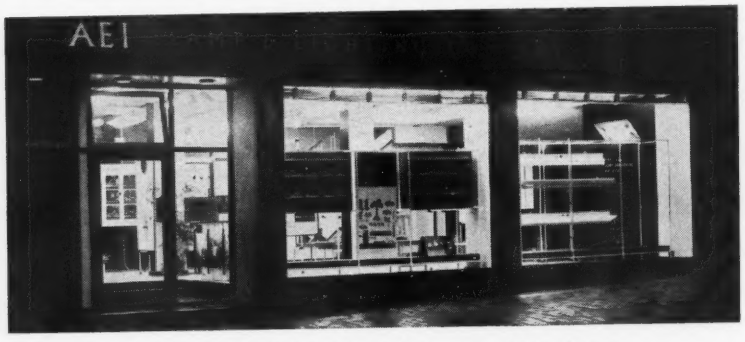
Atlas Distributors' Conference

A large number of electrical and hardware wholesalers attended a conference organised by the Atlas Lighting Division of Thorn Electrical Industries, Ltd., at Connaught Rooms on 4th September. New Atlas products were introduced, trade policy was discussed, advertising and publicity plans were presented, and a specially arranged I.T.A. transmission was received demonstrating the Atlas commercial television message. Mr. J. G. Christopher, general sales manager of the Atlas Lighting Division, presided.

Switchgear for the Snowy Mountains Scheme

The first switchgear for voltages over 300 kV ever ordered in Great Britain is to be made by the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, for the Snowy Mountains hydro-electric scheme in Australia. The order, which is valued at £125,000, was obtained by M-V's associates in Australia, Australian Electrical Industries Pty., Ltd., in the face of severe competition.

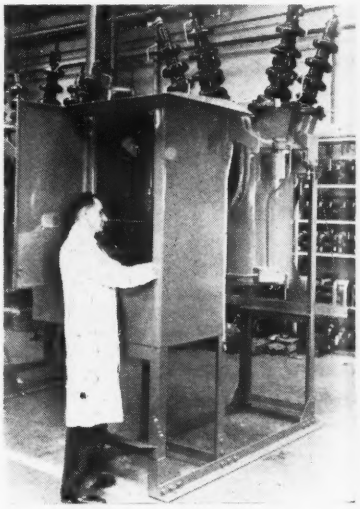
The new switchgear will consist of five 330 kV air-blast circuit-breakers, type GA11W8, rated at 1,200 A and having a breaking capacity of 10,000 MVA, together with the necessary compressor plant and eighteen 330 kV outdoor current transformers (with multiple secondaries). It will be installed in an outdoor switching station, 4,500ft above sea level, near the T1 underground power station of the Snowy Mountains Hydro-Electric Authority. The power station output of 320 MW will be stepped up by transformers to 330 kV and fed to the T1 switching station, which will be equipped with the five breakers just ordered. These will be connected by 100-mile long transmission lines to substations in New South Wales and Victoria, which will feed the existing power systems of the Electricity Commission of New South Wales and the State Electricity Commission of Victoria; future 330 kV lines will be extended to Sydney and Melbourne as the load demands. The five M-V circuit-breakers, which are due for commissioning during 1958, will complete the first section of the switching station, but a twelve-breaker station to be known as the T1/T2 station is ultimately envisaged.



The new A.E.I. Lamp & Lighting Co.'s showrooms in Birmingham

Switchgear for the United States

South Wales Switchgear, Ltd., last week dispatched the first of five 33,000 V oil circuit-breakers to the United States for installation in Wyoming, Missouri.



The first of an order for five 33,000 V oil circuit-breakers for the United States at the Blackwood Works of South Wales Switchgear, Ltd.

This switchgear has a penalty on the contract which stipulates that the equipment must be on site 150 days from the receipt of order and, since there are a number of special features on these oil circuit-breakers peculiar to the American market, the company has had to move quickly to complete this first breaker to time. The company believes that this first installation will be followed by many other orders, as the equipment is more economical in design than the American counterpart, and has an equally good performance to the American product.

Nash-Kelvinator Factory Fire

While extensive damage was caused by the recent fire at the Crewe factory of Nash-Kelvinator, Ltd., the company says that only a temporary upset of production is anticipated and trading will not be adversely affected.

Only one-third of the factory working space was involved and fewer than 100 out of the 850 employed are out of work; these will be absorbed again in about two months' time.

The company had planned changes in production lines and to tide over the period had built up stocks of its standard products. Although certain items may temporarily be affected, all reasonable demands can be filled.

The paint plant was destroyed, but offers of assistance have been received and the company is confident that there will be no hold-up for lack of a paint section.

Static Electricity Fire Hazards

A booklet describing the manner in which static electricity is formed and in which charges accumulate has been published by the Fire Protection Association. It suggests methods by which it may be dispersed or suppressed, and recommends precautions that can be taken in various processes, and in the handling of inflammable liquids and dusts, to counteract the risks of fire that arise. Copies of the booklet, "The Fire Hazard of Static Electricity," will be supplied free on application to the Association, 15, Queen Street, London, E.C.4.

Lamp Production in Ceylon

Our Colombo correspondent reports that the Kawai plan for an electric lamp factory for Ceylon has been accepted by the Government. The Director of Industries said the "service agreement" was now being drawn up. According to the agreement, Japan will hire the machinery, the technicians and the plant to get the factory going. The factory will be State-sponsored. The starting of a lamp factory was recommended early this year by the Japanese Colombo Plan expert, Mr. Takeo Kawai, who went to Ceylon to investigate its possibilities on the invitation of the Ceylon Government. Mr. Kawai reported that electric lamps to meet Ceylon's entire requirements of over 1,000,000 per year could be economically produced in Ceylon. The raw material for the glass envelopes is available in Ceylon. Only tungsten for the filaments would have to be imported. Mr. Kawai is the chief engineer of the Toshiba Electric Co., which produces, among other goods, 6,000,000 electric lamps a year.

Simon House

Simon-Carves, Ltd., have moved from their former London branch offices in Stratton Street to new and larger premises at Simon House, 28-29, Dover Street, W.1. This has enabled them to bring under one roof, in greatly improved working conditions, their own London staff and the staff of their subsidiary company, Huntington, Heberlein & Co., Ltd., who have relinquished their premises in Cromwell Road. Simon House is also used as a London office by Simon Handling Engineers, Ltd., and Henry Simon,

The new London branch offices of Simon-Carves, Ltd.

Ltd., though neither of these two companies maintains a resident London staff.

The new premises have five storeys and provide over 17,000 sq ft of office space. The telephone number is Hyde Park 8191 and the Telex number is 2-3165. The telegraphic and cable address of Simon-Carves is "Simcarlim, Piccy, London," and that of Huntington, Heberlein is "Innovation, Wesphone, London."

Anglo-Swedish Trade

The British-Swedish Chamber of Commerce in Sweden (Hovslagargatan 5B, Stockholm C.) is taking an unusual step in an endeavour to stimulate interest in trade between this country and Sweden. Usually the Chamber holds its annual general meeting in Stockholm in September. This year it was decided instead to hold a special meeting aboard the Swedish Lloyd ship *Suecia* at Millwall Docks, London, on 3rd October.

The postponed annual general meeting will be preceded by a luncheon to which a number of prominent British and Swedish guests will be invited. It is hoped that the arrangements will enable British firms to establish personal contacts with their Swedish counterparts.

During the first week of October, in conjunction with the meeting, the Chamber is arranging a series of visits to factories, institutions, etc., in the Greater London area and later the secretary of the Chamber, Mr. A. E. Wernley, is giving lectures and interviews in London and a number of provincial centres.

Furnaces for Tractor Production

For producing diesel crawler tractors the Caterpillar Tractor Co., Ltd., is building a new factory at Tannochside, near Glasgow. In connection with the scheme Birlec, Ltd., has been commissioned to build three roller hearth furnaces. The order consists of a 400 kW furnace for hardening forgings at the rate of 2,000 to 2,500 lb per hour; a 320 kW double ended furnace for tempering rough and machined parts previously hardened in the 400 kW furnace; and a 475 kW continuous driven furnace with cooling and soaking sections for cycle annealing 2,000 lb of components per hour.

Banana Ripening by Electricity

Electrical heating of banana rooms has been adopted by the Scottish Co-operative Wholesale Society, Ltd., in their new green fruit warehouse at Wallace Street, Glasgow. The normal medium for banana ripening has been gas, but some experimental work in the use of electricity for this purpose has been going on in Scotland. The banana floor has 25 rooms arranged in series and served by a conveyor system which elevates bananas from the rear loading bay to the second floor of the warehouse where the track continues on the horizontal plane passing each house. The rooms measure approximately 24ft by 10ft and the heating units are placed along the four walls of each house and consist of circular tubular heaters, with elements enclosed in light gauge metal, the loading being 80 W per foot. Thermostatic control is provided by a ceiling unit which is preset to the desired temperature, normally in the region of 65 deg to 68 deg F. Humidity is controlled in the early period of running in by the use of dampened sawdust, but it is anticipated that sweating of the stored bananas will build up a satisfactory humidity to allow this to be eliminated after a given period. The externally mounted controls include a temperature gauge to each house and a pilot lamp to show that the circuit is "alive."

Educational

A course of ten university extension lectures will be held on Fridays, commencing on 12th October, on technology and industry, at the University of London. The fee for the course is 15s (single lectures 2s), and tickets can be obtained from the Cashier, University of London, Senate House, Malet Street, W.C.1.

Consulting Engineers

The Association of Consulting Engineers has issued its 1956 list of members. Copies (members, 1s 6d, non-members, 2s) can be obtained from the Association at 36, Victoria Street, London, S.W.1.

Trade Announcements

Mr. D. Tallon, 38, Upper Mount Street, Dublin, has been appointed resident representative for **Honeywell-Brown, Ltd.**

The telephone number of **Lindsay & Williams, Ltd.,** Manchester, is now East 2686.

British Association

Further Proceedings at the Sheffield Meeting

Last week we reported a number of addresses and papers at the meeting of the British Association for the Advancement of Science at Sheffield. Other matters of electrical or allied interest are dealt with below.

RECENT developments in the physics of fuel combustion were reviewed by Professor M. W. Thring (Sheffield University) at a joint session of the Mathematics and Physics Section and the Engineering Section. He described experiments with a pre-mixed fuel-air stream injected radially at very high velocities through a number of small holes in a small sphere at the centre of a large refractory-lined sphere.

Almost homogeneous mixing of the combustion products and the incoming fuel-air mixture showed that heat release rates of 10^8 CHU/ft^3/hr were obtainable when the physical processes were sufficiently rapid. It proved that the chemical reaction rate was so fast at the temperatures prevailing in practical flames at normal pressures that the factors limiting combustion rates were entirely the physical factors of mixing and heat loss from the flame.

The combustion intensity in a pulverised-coal-fired boiler was at 10^5 CHU/ft^3/hr and if the firing rate were pushed above this value unburnt carbon appeared in the gases leaving the combustion chamber. The fraction of the volume of the combustion chamber used for igniting the fuel stream was relatively small, so that the main problem was that of macro and micro mixing—bringing the oxygen first between the coal particles and then to their surface.

His conclusions were that lighter liquid fuels burned by evaporating under the action of heat conduction to the droplet from the flame of vapour burning round it, and that heavier hydro-carbons burned partly in this way and then formed a residual coke particle which burned more slowly than the volatile component. When a liquid droplet or solid-fuel particle were burning by one mechanism alone, the rate of loss of mass was approximately proportional to the first power of the diameter, so that the total time of combustion of a particle was approximately proportional to the square of its initial diameter. This was why in burning pulverised coal it was the fraction of coarsely ground coal which gave the most trouble.

Much more research remained to be done in the no-man's land between industrial combustion systems and the laboratory differential equations before the latter could be used for complete design calculation of the former. The chemistry of combustion had been more studied in the past than its physics, but this situation was being remedied, particularly in view of the needs of rockets and gas turbines.

Automatic Process Control

The great advance in the automatic control of processes in the last 25 years was described by Mr. A. J. Young (I.C.I., Ltd.). At the I.C.I. works at Billingham there were about 1,200 controller installations—an investment of more than £500,000—but one could walk round such a factory and see only one man sitting in the control room, but that was not the same as seeing a completely automatic factory. Control had developed over the last thirty years to the present stage in which many processes were virtually controlled automatically, but that was quite different from complete automatic control without a human operator.

Electronic computers were being developed for process conditions and would be used first in the very large factories. In time, the electronic computer might be the master controller which would govern the individual controllers or perhaps even the adjusting valves. Although most control systems in industry were pneumatic, there was a trend towards electricity. One difficulty was that of flameproofing.

During the last ten years control system design had begun to influence the design of plant with a view to ensuring that the time lag between a change in a process and the compensating adjustment did not prevent the precision of control demanded for economic operation.

The application of digital computer and feed-back servo-mechanism techniques to measurement and control was said by Dr. D. T. N. Williamson (Ferranti, Ltd.) to have given rise to the construction of machine tools which gave fully automatic production with an equivalent setting time of less than one-fifth of the time necessary to make one component by hand.

The system developed utilised a special purpose digital computer capable of supplying a large number of controlled machine tools with magnetic control tapes. Its function was to accept basic dimensional and machining information, in its simplest form, about the component to be made and from this to calculate the movement of the centre of the cutting tool, recording this information on magnetic tape. This magnetic tape was placed in the reader of a control unit, associated with the machine tool, which controlled servo-mechanisms to move the slides rapidly and accurately in accordance with the instructions it gave.

The movements of the slides were measured by an electro-optical system utilising precision diffraction gratings. The signals from this system were used as feed-back in the servo-mechanisms to ensure that the commands from the magnetic tape had been executed precisely. The equipment was capable of measuring increments smaller than 0·0001in.

Mr. J. F. Coales (Cambridge University) described a Russian piston-making factory, in operation since 1951, which carried out ten processes in succession, without handling, from the continuous production of liquid alloy to covering the finished pistons with anti-corrosive grease and packing them.

A detailed description of an automatic uranium analyser was given by Dr. D. Taylor (Harwell). The instrument employed an absorptiometric technique for the determination of uranium-ion concentrations in aqueous solutions. Volumes of samples and chemical reagents were measured and controlled by capacitance-level indicators and electrically-operated valves.

Mr. D. R. Bomford (president, Institution of British Agricultural Engineers) referred to the possibility of developing a new range of agricultural machines if a start could be made with ploughs which needed no driver.

Dr. A. D. Booth (London University) described an experimental translating machine in which the normal form of input of a message was *via* a teletape. Alphabetical symbols were automatically converted into a five-hole code

suitable for input directly to an automatic computer. The aggregate of coded impressions making up a word could be regarded as a binary number on which the machine could operate normally.

Even with the 1,000-word "dictionaries" to which present machines were limited, adequate translation was possible of 90 per cent of words in most scientific passages by dividing the "dictionary" into two parts—the first containing words in common use and the second words peculiar to the subject.

The cost of these machines, translating into French, might be thirty times that of a human translator, but machines to be built in the next five or ten years might use magnetic-drum storage, the cost of a 60,000-word store being £3,000. The effective cost of translation might be reduced to £3 an hour.

Heat-Pump Applications

The extraction of waste heat from the sewers by a heat pump was suggested by Miss M. V. Griffith (Electrical Research Association). Hot water was thrown away by industry, houses, hospitals and hotels at temperatures of 25 to 30 deg C and much of it could be used by heat pumps at a performance-energy ratio of seven to one. Cooling water from power stations was used in Britain for the heating of their administrative offices. Heat pumps could have been used for the Pimlico housing scheme but it was felt that there was insufficient experience of their working.

Another source of heat was the soil. On average a 1ft length of ¾in diameter pipe in British soil would continue to pick up heat at the rate of 10 W all through the winter. A heat pump with 500ft of pipe in the soil would be sufficient to heat a house, but it would cost from £300 to £400 to install the pump and equipment in a new house. The aim was to reduce the capital cost to about 1½ times that of a conventional central heating system.

Wing Commander Cave-Brown-Cave, the chairman, said one of the difficulties was that the large quantities of waste heat often existed some distance from the cities where it was needed.

Special Glasses

New glasses of novel compositions and physical and chemical properties in the electronic industry were described by Dr. J. H. Partridge (G.E.C. Research Laboratories). A high alumina alkali-free glass of high softening point, possessing high electrical resistance at temperatures up to 700 deg C, was manufactured for the envelopes of high-pressure mercury vapour discharge lamps and a silica-free glass for sodium discharge lamps. A slight modification in the composition of the silica-alumina eutectic mixture produced a glass of very low thermal expansion which was used for sealing tungsten conductors through fused silica.

Alterations to the composition of the high resistance glasses used to insulate the current conductors in electronic devices had produced glasses of much higher specific electrical resistance at operating temperatures of 150 to 300 deg C.

Research Expenditure

Expenditure, per head, on civil research and development in the U.S.A. was stated to be more than three times that in this country, according to a survey by the Department of Scientific and Industrial Research presented in the Economics Section. The survey stated that in 1955-56 Britain spent about £325 million on research and development (subject to possibility of error as high as £80 million). Of this sum, £185 million was spent by private industry, mostly by aircraft, electrical engineering and chemical firms. The estimated expenditure by electrical engineering firms was £32 million.

Altogether, 130,000 people were engaged in research and development in British industry, but only 100,000 spent all their time on it. Electrical engineering devoted 4 per cent of its man-power to it. Industry in the United States had six times as many graduates on research and development as had British industry.

Nuclear Power Development

Although he forecast that the problems of the fusion reactor would be overcome before the world exhausted its uranium supplies, Sir John Cockcroft (Director, A.E.R.E., Harwell), lecturing on the future development of atomic energy, regarded its development as a longer-term project than the fast breeder reactor. At the moment, work on the fusion reactor was a research and laboratory project. It was hoped to achieve temperatures of 100 million deg C and to use magnetic fields to insulate the walls of the container.

The U.S.A. planned to build 20 experimental nuclear power stations in the near future and by 1962 would have an installed capacity of nuclear power similar to that in Britain. Their reactors would use water instead of graphite to slow down neutrons; this would reduce capital costs but would create corrosion problems and probably increase fuel costs. In any event, nuclear power would play a lesser part in the American economy than in the British economy in the next 10 to 15 years and might provide only 1 per cent of their total output. The Russian programme was similar to the American and by 1960 would give a total installed capacity of about 2,000 MW. Nuclear power in Russia was expected to cost 50 per cent more than conventional power—partly because of the use of enriched fuels, but in view of their proposals to build many hydro-electric stations, nuclear power would be relatively less important.

The need for 5 to 20 MW units was a characteristic of under-developed countries. Conventional-fired stations met that need at 1½d to 2d per kWh, which could hardly be met more cheaply with small nuclear units. The latter needed enriched fuel, which was both scarce and expensive. By 1965, however, it might be possible to produce nuclear power in small units.

Commercial propulsion of ships was not yet feasible. At the moment, capital and fuel costs were four times those of a diesel propulsion unit, although a single charge was expected to drive the American atomic submarine, *Nautilus*, for two years before replacement. A team from the ship-building industry was studying the problems at Harwell.

The uranium requirements of the Western world would be covered adequately in the next five to ten years from proved sources. Principal Commonwealth sources were the South African gold mines and North-Western Ontario, where mines were likely to be in large-scale production by 1958. The cost of uranium would probably fall.

The recent introduction in Britain of a beryllium-alloy shield had led to greater output per reactor. The first charge of fuel in a nuclear power station would probably last three to four years before replacement. The spent charge would contain 2 kg of plutonium per ton of uranium, which could be separated at Windscale.

The second phase of the British programme included reactors in which heat was removed by water or liquid metal and the third envisaged the introduction of the breeder reactor in which a blanket of natural uranium surrounded the core of pure fuel in which the chain reaction took place. Neutrons escaped into the blanket and turned

heavy uranium into plutonium. In a full-scale reactor, 1·7 plutonium atoms might be created for every atom destroyed. The Dounreay fast breeder reactor was intended to come into operation by 1958, but stations of this type were not expected to make an important contribution to electricity before 1970.

Magnetic Materials

At a joint session of the Mathematics and Physics and the Engineering Sections, Professor W. Sucksmith (Sheffield University) presented a paper on developments in magnetic materials. Conductive magnetic materials, both soft and hard, appeared to be at a stage where the relevant qualities were reached only in exacting laboratory conditions, practical applications becoming more and more controlled by industrial expediency. As for non-metallic materials, rapid extension of a.c. applications, particularly at high frequencies, gave promise of a very widely expanding future.

Fifty years ago, practically no magnetic materials were manufactured for specific purposes. Permeability and coercivity, although not the only factors contributing to the improvement of ferromagnetic material, were undoubtedly the most prominent. Two Japanese discoveries, the oxide magnets of Kato and Mishima's magnet steel, were a consequence of the hardening of nickel-iron alloys by the addition of aluminium. From post-war systematic development of this type of alloy had emerged the most strongly magnetic of to-day's permanent magnet materials.

Sintered oxides had recently appeared which, as represented by BaO $(Fe_2O_3)_6$, were virtually ceramic and were fabricated in rings for focusing television tubes. Material of similar crystalline structure but with potassium replacing barium was non-ferromagnetic.

There was a possibility of concentrating shape and crystal anisotropy all in one direction, so that the effects were cumulative, by cooling the alloy from the melt in a high-temperature gradient, the direction of which coincided with the applied magnetic field.

Soft magnetic materials were conditioned by the negation of the very properties which were decisive in producing high efficiency in hard materials. The properties which contributed to maximum coercivities must here be kept low. In addition, all impurities, imperfections and dislocations must be removed and the perfect lattice produced. The best example of these conflicting requirements was in the high permeability Fe-Ni alloys, which showed that the ideal could not be attained and that there had to be compromise. The situation was further complicated by the fraction of the super-lattice $FeNi_3$ which existed over a wide range of composition.

A new type of soft magnetic material which appeared most promising had been produced in Holland. While its intensity was low it had the great advantage that, unlike the ferromagnetic metals, it had no conduction electrons and thereby should be an insulator in which there were no eddy current losses. It could be used with advantage at higher frequencies and the author saw a big future for it in mechanical computers and wave guide elements at microwave frequencies.

Dr. A. Edwards (James Neill & Co.) referred to Sheffield as the largest centre of magnet production in the world. Japanese inventions, cobalt steel and iron-nickel-aluminium alloy were developed there and the production of Alnico and the first anisotropic magnet were Sheffield inventions. The fully anisotropic alloy Alcomax could now be cast with a controlled columnar structure and had outstanding magnetic properties, although too expensive for commercial use. A cheaper alternative, a semi-columnar alloy, had been introduced this year. Current magnet production approached one magnet per head of the population per annum.

Dr. E. W. Gorter said that ferromagnetic oxides with a general formula MFe_2O_4 and having the same cubic crystal structure as the mineral spinel found ever-increasing use in electrical and communication engineering, because their high electrical resistivity allowed the use of unlaminated pieces of these materials at high frequencies, where metallic core materials would be unusable because of eddy current losses. " The magnetic ions in these materials were found in two types of sites in the structure, A and B, and the magnetic moments in A and B sites were antiparallel," he said. Thus in $NiFe_2O_4$ the A sites contained one-half of the ferric ions, the B sites nickel and the other half of the ferric ions, so that the resultant moment was that of the nickel only.

Properties of Ferrites

Solid solutions existed between a wide variety of ferrites. While $ZnFe_2O_4$ zinc ferrite was non-magnetic, solid solutions between $NiFe_2O_4$—nickel ferrite—and $ZnFe_2O_4$ had a higher intensity of magnetisation than $NiFe_2O_4$ because Zn^{2+} entered the A sites, thus decreasing the moment of A and increasing the difference between the moments in B and A sites.

The permeability, losses and other properties were dependent on the intensity of magnetisation but also on the stiffness with which the magnetic moments were bound to certain directions of each crystal, to directions of stress or internal strain and to the shape of air pores in the ceramic materials. By incorporating enough Zn in the solution, the Curie temperature, at which the ferromagnetic properties disappeared, was brought down to, say, 120 deg C, and these stiffnesses, which decreased towards the Curie temperature, became small and a high permeability resulted.

For cobalt ferrite, the magnetic moments were strongly bound to the cube edges of each crystallite, making it a permanent magnet material. For the other ferrites they were much less strongly bound to the cube diagonals. Thus, materials with small amounts of cobalt in solid solution had low stiffness, and this had led to materials with low-temperature dependence on permeability.

Ferrous ions were detrimental to the resistivity and must be avoided, but the dependence on stress of Fe_3O_4 had a sign opposite to that of all other ferrites, so that small additions of Fe_3O_4 in solid solution would eliminate strain dependence and thus increase permeability. For computers ferrites with rectangular hysteresis loops were required.

A uniaxial anisotropy was introduced in cubic ferrites by cooling ferrites containing cobalt in a magnetic field. The probable explanation was that at higher temperatures diffusion of Co_2^+ ions took place so that strings were formed in the general direction of the magnetic field, which destroyed the cubic symmetry. This resulted in permanent magnet materials, cobalt-ferrous ferrites, or in extremely rectangular ferrites with low coercivity, when sintered at much higher temperatures.

Better uniaxial oxides for permanent magnets included the barium-iron-oxide $BaFe_{12}O_{19}$—or $BaO6Fe_2O_3$—which was hexagonal and therefore had only one axis of preferred orientation of the magnetisation.

At very high frequency a.c. fields the necessary magnetic moments would resonate with the a.c. field, thus causing high losses. This would occur at frequencies which were higher when the processing was reduced by a greater stiffness. Thus, high permeability—e.g. 1,000-2,000 equals low stiffness—could not be obtained at the same time as low losses in the highest frequency range—for example, 100 Mc/s.

I.E.E. WIRING REGULATIONS

Interpretation of Their Requirements

REPLIES to inquiries regarding the application of the 13th edition of the Regulations for the Electrical Equipment of Buildings, which came into force in September, 1955, have been issued by the Institution of Electrical Engineers. A selection of rulings of the Wiring Regulations Committee on cases of most general interest are summarised below.

Cables whose aggregate current rating is not less than that required by Regulations 108 and 203 may be connected in parallel, but the maximum number desirable (lead and return) is two. On a.c. systems (Reg. 219 (B)) bunched cables in steel conduit must have all phases and neutral (if any) in the same conduit.

Subject to the exemptions stated in Reg. 108 and 316(B), a circuit-breaker designed for instantaneous operation must be set to function at not more than twice the current rating of the cable protected. If fitted with time delay only or having an inverse-time characteristic, the normal continuous current, when appreciably above that at which the breaker operates within a stated time, must not exceed the cable rating. Where both instantaneous and time-delay settings are employed one at least is required to comply with the foregoing.

Single-phase final subcircuits taken from a three-phase four-wire source must be separate and their neutrals connected only at the distribution board. The whole of such a subcircuit serving several points may be regarded (for the purpose of 112 (B) and Note 1) as a single part of the installation. A common neutral may therefore be looped from point to point within this subcircuit, provided one pole is earthed by the supply undertaking.

A junction box for connecting spurs to ring circuits should comply with B.S. 816 and the rating of its terminals should be not less than that of the cable ring, namely, 20 A. Voltage drops under Table C should be based on the actual currents used in the calculation of maximum demand, which must fall within the rating of the subcircuit (114 (B)). For circuits (other than final subcircuits) where diversity is applicable, voltage drop calculations should be based on the sum of the normal full-load currents reduced by a diversity factor to be assessed by a competent electrical engineer or on the values given in Table 1 when applicable. Attention is drawn to Note 2 of Reg. 204 (A) about the starting of motors.

Conductor Identification

Colour identifications for phase conductors of single-phase circuits derived from a three-phase supply (Table 7) may be used up to the final distribution board but not desirably for final subcircuits or to distinguish circuits connected to the same phase. Green should not in any event be used for a live conductor and black should be avoided for single-core cables. Identification required for convenience during wiring is preferably by other means than colour, e.g. by numbers.

Every core of rubber-, p.v.c.- and polythene-insulated cables must be identified at its terminations and preferably throughout its length (Reg. 206 (A)), normally by the colours set out in Table 7. A non-sheathed cable with an overall braid for mechanical protection may be identified by the colouring of this braid, or during installation by sleeves of the appropriate colours at its terminations.

The definition of "incombustible" is amplified by the information given to one inquirer that the plastered surface of lath and plaster or plaster over plasterboard has a good fire resistance and that plasterboard used alone, where continuous and free from cracks, is incombustible unless paper covered (when, however, it still has a Class 1 spread-of-flame test classification). Hardboard is not incombustible. Conduit may not be installed underground for wiring between buildings except for cable conforming to Reg. 229 (B) (1).

Heating Appliances

A separate linked switch is required, subject to Reg. 314 (B) (1), for controlling a non-portable heating appliance having elements exposed to the touch, assuming a connection by plug and socket-outlet is not used and one pole of the supply is earthed by the undertaking. Connections are to be so arranged as to permit dismantling of the appliance for maintenance without necessarily exposing any parts remaining alive when the switch mounted on the appliance is off. If, however, connection to a ring circuit is by plug and socket-outlet, the plug being readily accessible when the appliance is in use, this meets the requirement of a means of disconnection of all the supply conductors.

Compliance with B.S. 1945 and 1670 does not in itself imply that the screening is such as to prevent touching the elements, thus giving exemption from the requirement (in Reg. 354) regarding the breaking of all supply conductors whether by a linked switch or withdrawal of a plug from a socket-outlet. A panel fire complying with B.S. 1670 has a double-pole switch, thus removing the need for an external switch, provided the requirements of Reg. 314 (B) (1) are satisfied.

In a room containing a fixed bath, the switch or adjustable thermostat controlling a non-portable appliance must be out of reach of a person in contact with the bath (Reg. 405 (B)). Otherwise the switch should be operated by an insulating cord or placed in an accessible position outside and immediately adjacent to the door (Reg. 314 (B) (iii)). Only in a bathroom is it essential (Reg. 405 (A)) for lampholders to be fitted with protective shields or otherwise shrouded.

At the distribution board supplying a motor and its starter, a fuse of greater rating than that for full-load current of the motor may be needed to allow for starting current. Under the exemption to Reg. 316 (B) the fuse rating must not exceed twice the rating of the cable between the distribution board and the starter, so that in this part of the circuit a cable of greater rating than the sustained current of the motor may be required. Earthing arrangements must be adequate in relation to the fuse rating (Reg. 406).

The revised ratings of paper-insulated and varnished-cambric-insulated cables (Tables 16 to 22) are applicable when cable boxes are filled with normal grades of compound and the metal sheaths of the cables can be touched. This ruling is subject to the rating factors given for higher ambient temperatures than those stated, for special dispositions of cables and types of sheaths and also for the requirements (Reg. 204) regarding voltage drop. Com-

pounds should be suitable for the maximum conductor temperature (about 158 deg F) liable to be obtained with continuous operation at the full ratings modified as above. Fusegear and switchgear connected to the cables must also have a suitable temperature rating. The maximum sheath temperature in these conditions is likely to reach 140 deg F and protection to comply with Regulations may sometimes be needed.

Trade Union Policy

AUTOMATION DISCUSSED AT THE T.U.C. BRIGHTON MEETING

THE 88th annual Trades Union Congress was held at Brighton last week and the discussions, as usual, ranged over a great number of political and economic subjects. In his presidential address, Mr. W. B. Beard, O.B.E., said that although the main object of the trade unions was the maintenance and improvement of the conditions of employment of their members, to do that job effectively they had to consider many matters and they expected to be consulted by the Government and employers.

Mr. Beard criticised the Government's economic policy which he said was bound to increase inflationary difficulties. It encouraged manufacturers to supply the home market at the expense of exports and this worsened our trade balance. He advocated a planned economy to rectify the position. He denied that the " inflationary spiral " had been caused by wages; the Government must be more resolute in tackling the question of investment.

The General Purposes Committee failed to get agreement on a comprehensive composite motion from the several that had been put down on automation. Two were before Congress and were debated separately. The first, moved by the Electrical Trades Union, seconded by the National Union of General and Municipal Workers, and supported by the National Union of Vehicle Builders and the Constructional Engineering Union, believed that the introduction of automation into industry and commerce provided the possibility of better living standards and greater leisure. Congress, it stated, was not opposed to automation developments which were recognised as inevitable, but it was resolved that the interests of trade union members should be safeguarded against any ruthless application of automation by employers, and that the wages and conditions of workers in occupations not easily converted to automatic processes should not lag behind those in manufacturing industry. It was determined that full employment should be maintained. Then came the demands:—

(*a*) That where automation was to be applied or contemplated it was essential that discussion between the employer and the employees' representatives should take place;

(*b*) That in such discussion it was the responsibility of the unions to ensure that the fullest consideration was given to recruitment and training policies and the avoidance of redundancy, the maintenance of the level of earnings, and reductions in the prices of commodities being produced, and where labour was displaced adequate maintenance should be paid.

Mr. F. L. Haxell, general secretary of the Electrical Trades Union, who moved the resolution, said the idea that electronic and mechanical devices resulted in greater employment and higher living standards was valid only in an expanding economy, with an expanding market and increased purchasing power. Automation was primarily a device for reducing labour costs. It would be futile to imagine that employers were motivated by altruism or public-spirited intentions. There was no guarantee that automation would result in falling commodity prices. It was " sheer humbug " to suggest that it would improve the lot of the people or the country's economy. It might lead ultimately to higher profits, a reduction in the labour force and in purchasing power, unemployment and economic crisis.

The people would benefit only to the extent that the Labour Movement was able to force the Government and employers to adopt measures of economic control that would increase production, raise wages, improve purchasing power and curb high prices.

Mr. Harry Douglas, general secretary of the Iron and Steel Trades Confederation, said there were certain facts that could not be ignored, even if they were put forward by a Conservative Chancellor of the Exchequer. If the increase in earnings exceeded production there could be no improvement in the standard of living. Even if investment in automation took place now, it would be several years before it would produce benefits. To say its benefits depended on the type of Government they had was " sheer rubbish."

The second motion, moved by Mr. Harry Knight, general secretary of the Association of Supervisory Staffs, Executives and Technicians, affirmed that only by national planning in the interests of the whole community could the introduction and application of automation and nuclear power provide the maximum benefit for all people. The General Council should call upon the Prime Minister to set up without delay a permanent commission or national planning board for automation under the control of a responsible Minister, on which the T.U.C., the employers and scientists would be represented.

The purpose of such a body would be, among other things, to establish standardisation of electronic equipment and control mechanisms; to provide measures of compensation and protection against hardship in unavoidable cases of redundancy; and to agree to adequate allowances to cover necessary cases of mobility of labour arising from automation.

Mr. Knight drew attention to the advances being made in automation in the United States, France, Belgium, Germany and Italy, and said we could not overlook the possibility of being outpriced and outproduced. But his plea for a national planning board, opposed by the General Council who supported the first motion, was rejected by Congress. The motion sponsored by the Electrical Trades Union was carried on a show of hands.

Two motions on technical education were debated and carried. The first, moved by the Engineering Surveyors' Society, welcomed the statement of the Prime Minister that technological and scientific education facilities were to be enlarged. But it drew attention to the need for better standards of pay and prospects for salaried engineering and scientific employees, in order to attract sufficient candidates to the profession.

The second motion welcomed the White Paper on technical education (Cmd. 9703), but it asserted that higher technical education should rest on an adequate system of secondary education. It therefore urged that " the artificial separation of children into grammar, technical and modern streams at eleven years of age should be ended, and every encouragement given to the development of comprehensive schools," and that the minimum school-leaving age should be increased to 16 years.

Wages and the Economic Situation

As had been generally forecast, the long, comprehensive composite motion on wages and the economic situation received almost general approval. It incorporated the substance of twelve motions. Although it recognised the critical weakness of the national economy, it put the blame largely on the Government for recent inflationary trends and for abandoning economic controls. It asserted the right of labour to bargain on equal terms with capital, and to use its bargaining strength to protect the workers from the dislocations of an unplanned economy. It rejected proposals to recover control by wage restraint, and by using the nationalised industries as a " drag anchor " for the drifting national economy. Finally, it instructed the General Council to make renewed representations to the Government for a return to a planned economy, based upon effective economic controls, as offering the only practical means of redressing the balance.

Mr. W. L. Heywood, chairman of the General Council's Economic Committee, said that when the economy got out of control last year some temporary reduction in investment and types of demand was inevitable. Congress recognised that steps had to be taken, and did not criticise the Government for taking action. But it was Congress's view that it was necessary to maintain the framework of controls as protection against fluctuations in world trade to which we were exposed. Both nationalised and private industry had given undertakings that prices would be kept steady. It was to be deduced that the Government expected that the employers would use the stronger bargaining position created by financial stringency and a less buoyant demand for labour to resist wage applications more strongly than in the past.

The T.U.C. welcomed action by the Government which would effectively keep down the general level of prices, but if this policy was to be the cause for rejecting applications for better conditions without regard to the merit of those applications, then Congress was opposed to it.

Decisions on wages were not in the hands of the General Council, but rested with the executives of the affiliated unions. The General Council's function was to advise, but the Council was confident that the unions would conduct their affairs prudently and sensibly.

Mr. F. Cousins, general secretary of the Transport and General Workers' Union, then moved the composite motion. He asserted that the motion was not in opposition to the economic report of the General Council. Nor did it attempt to establish whether his union was in one camp or another. Mr. Cousins attacked the Government and its economic policies. It also made clear that the paragraph in the motion asserting the right of labour to bargain on equal terms with capital was " no pious statement."

Mr. A. L. Horner, general secretary of the National Union of Mineworkers, referred to the assurance given by the National Coal Board that, unless there was a marked change, coal prices would not be further increased, but that statement did not commit the N.U.M.

The motion was carried without dissent.

The Association of Scientific Workers moved a lengthy motion on radiation hazards. It called for properly constituted measures of control and " noted with satisfaction " the excellent record of the Atomic Energy Authority in radiation protection, but it was " concerned at shortcomings in radiation protection within the National Health Service." Finally, the motion considered that there was an immediate and urgent need for protective legislation, directed in particular (1) to enforce those standards of safety which had been agreed by the International Commission on Radiological Protection upon all establishments which made use of radioactive materials or ionising radiations; (2) to ensure that the supply of radioactive materials and ionising radiations was so controlled that they would be withdrawn or withheld from establishments failing to conform to the standards of safety laid down.

Congress approved the motion.

Although it was opposed by the General Council, a motion was carried confirming support for a 40-hour week and stating that the time was now opportune to achieve it.

Mr. Frank Foulkes, general president of the Electrical Trades Union, in a reference to short-time working in the Midlands, said it was not the job of the trade unions to assist employers to share out the poverty of their members. They wanted a shorter working week for all.

Mr. F. Cousins, for the General Council, said the Council was not opposed to the principle of the motion, but to its wording.

Heat Treatment of Aluminium

A REVISED edition of " Notes on the Heat-Treatment of Aluminium Alloy Castings " has recently been published by Alar, Ltd. (a technical association of light alloy refiners), which replaces the 1950 issue. It makes the point that by far the greater proportion of castings are used in the " as-cast " condition, although there are a number of special applications for which higher mechanical properties are required. A very considerable increase in strength and hardness, compared with the as-cast condition, is obtained by heat-treating castings of suitable alloys, and the purpose of the notes is to set out briefly the conditions applicable to treatment of the various alloys, the scope and limitations of the process and the precautions to be observed.

With the exception of the sections describing solution treatment and quenching, which do not apply to pressure diecastings, the practice described applies to all three forms of castings, i.e., sand, gravity and pressure die-castings. A section of the notes is devoted to heat-treatment not to improve mechanical properties but to remove casting and other stresses and so promote dimensional stability. Heat-treatment for the improvement of mechanical properties usually consists of three main operations which are dealt with separately; they are—solution, quenching and precipitation.

The conditions for the heat-treatment of the B.S. 1490 alloys are set out in a table and working details are given in the text. In solution treatment the castings are heated at about 500 deg C (depending on the alloy) until certain of the alloy constituents have been taken into solid solution, and then the castings are rapidly quenched. In this condition the castings are usually stronger than as-cast and have maximum ductility, but most alloys are further strengthened by precipitating the dissolved constituent in an extremely fine form by heating the castings at a temperature of about 160 deg C. The notes describe very briefly the types of furnaces for each treatment; stacking and quenching to reduce distortion; the effect of varying times and temperatures in heating and quenching; how solution treatment may sometimes be avoided; hardening at ordinary temperatures; and annealing. A section explains why pressure diecastings cannot usually be fully heat-treated, and a form of treatment which removes the likelihood of a very small change in dimensions occurring in instrument castings after manufacture and prevents growth in castings, e.g., pistons, used at elevated temperatures, is described.

DOMESTIC ELECTRICAL EQUIPMENT

Electric Cookers

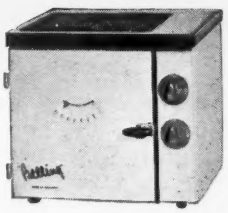
THE modern electric cooker commends itself to the housewife because of its ease of operation and economy; it is also the means of achieving more successful meals. As can be seen from the following survey there are now few cooker manufacturers who do not offer either a fully automatic model or an automatic control panel for converting an existing cooker to automatic operation. Such control panels can be added at any time in place of the normal splashplate and require very little time to fit.

Although solid type hotplates are mostly fitted as standard to cookers, radiant hotplates are available at extra cost, as well as additional " Simmerstat " controls, etc. Oven control is almost without exception thermostatic.

The tendency towards colour in the kitchen continues and although most electric cookers are normally finished in cream or white enamel, handles and control knobs on some models can be had in a choice of colours to match existing decorative schemes. The range of Belling cookers is also available in attractive colour combinations including blue/white, blue/cream, green/white, green/cream, black/white, black/cream as well as white and two-tone cream. Hob colours available for the " Revomatic " cooker include red, blue, green, yellow and grey.

Prices are, in some cases, slightly higher than a year ago but in general there has been little change. It will be remembered, however, that the electric cooker is one of the few remaining items of domestic electrical equipment which does not bear purchase tax.

Manufacturer	Name or Model	Type	Size (H.W. & D. in inches)	Oven Type	Oven Size (H.W. & D. in inches)	Oven Loading	Type of Element	Oven Control
BELLING & CO., LTD., Southbury Road, Enfield, Middlesex.	64AB Streamline	Vertical	37×23½×23	Removable (one-piece)	16×15×13	3,400 W	—	Thermostatic
	47AB	Vertical	36×21×21	Removable (one-piece)	13×13×16	2,500 W	—	Thermostatic
	45A " Baby Belling "	" Baby "	21×18×15⅝	Fixed	11¼×13×13	1,200 W	—	Three heat
	51 " Wee Baby Belling "	" Baby "	12×13¾×11⅜	Fixed	9¼×9×9¼	600 W	—	Three heat
	53 " Big Baby Belling "	Stand or cabinet	36×21×16	Fixed	11⅜×11⅜×11⅜	1,000 W	—	Three heat
	29	Table	9×16½×12	—	—	—	—	—
	" 53-Plus "	Stand or cabinet	36×21×16	Fixed	11⅜×11⅜×11⅜	1,000 W	—	Thermostatic
	" 47-Plus "	Vertical	36×21×21	Removable (one-piece)	13×13×16	2,500 W	—	Thermostatic
	" 64-Plus "	Vertical	37×23½×23	Removable (one-piece)	16×15×13	3,400 W	—	Thermostatic
BRITISH NATIONAL ELECTRICS, LTD., Newarthill, Motherwell, Scotland.	" Britannia " Two-plate	Vertical	36×21×21 (plus 9in splashplate)	Removable side panels	13⅛×13⅛×15	2,500 W	—	Thermostatic
	" Britannia " Three-plate	Vertical	36×21×21 (plus 9in splashplate)	Removable side panels	13⅛×13⅛×15	2,500 W	—	Thermostatic
	" C.90 "	Vertical	36×21×21 (plus 9in splashplate)	Removable side panels	13⅛×13⅛×15	2,500 W	—	Thermostatic
CARRON COMPANY, Carron, Falkirk.	L.2	Vertical, legs or plinth	36×22×21	Fixed with single element in bottom	12⅝×14⅞×14	2,400 W	Plug-in special finned sheathed type	Thermostatic



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1. *"Wee Baby Belling"*
2. *Belling 47AB*
3. *British National Electrics "Britannia"*

Oven Control	Hot Plates	Grill or Grill Boiler	Hot Cupboard or Grill Compartment (H.W. & D. in inches)	Storage Drawer (H.W. & D. in inches)	Storage Drawer Loading	Special Features	Finish	Price
Thermostatic	One 8in 2¼ kW One 6in 1 kW "Simmerstat" controlled	10½×8in 2·3 kW grill boiler	7×16½×16½	—	—	Inner glass door, automatic oven floodlight and (as extra) wheels with brake	White or cream, black hob, vitreous throughout	£52 10 0
Thermostatic	One 8in 1·8 kW ("Simmerstat" controlled) and one 6in 1 kW (three-heat control)	10½×8in 2·3 kW grill boiler	6×18⅜×15½	4×16×15	—	Inner glass door	White or cream, black hob, vitreous throughout	£34 5 0
Three heat	—	10⅜×8in 2 kW grill boiler	4½×17⅜×15	—	—	Available on stand (£2 4 0 extra) or cabinet (£4 8 0 extra)	White or cream, black hob, vitreous throughout	£14 17 6
Three heat	—	9×7in 1·5 kW grill boiler	—	—	—	—	Cream and black vitreous enamel	£7 19 6
Three heat	One 8in solid 1·8 kW	10×7in 2 kW grill boiler	5×19×14	—	—	Switch interlock limits load to 3 kW	Cream and black vitreous enamel	£19 17 6 (on stand) £21 17 6 (on cabinet)
—	—	10½×8in 2·3 kW grill boiler	7×10⅞×12⅞	—	—	Three heat or "Simmerstat" control	White or cream and black vitreous enamel	£7 8 6 (three heat) £8 2 6 ("Simmerstat")
Thermostatic	One 8in solid 1·8 kW	10×7 2 kW grill boiler	5×19×14	—	—	Auto-oven timer, built-in timer and pilot light	Cream and black vitreous enamel	£30 17 6 (on stand) £32 17 6 (on cabinet)
Thermostatic	One 8in solid 1·8 kW "Simmerstat" controlled One 6½in solid 1 kW three heat	10½×8 2·3 kW grill boiler	6×18⅛×15½	4×16×15 (unheated)	—	Auto-oven timer, built-in timer, tubular lamp floodlight, built-in 13A socket outlet	White or cream, black hob	£47 10 0
Thermostatic	One 8in solid 2·25 kW One 6½in solid "Simmerstat" controlled	10½×8 2·3 kW grill boiler	7×16½×16½	—	—	Auto-oven timer, built-in timer, tubular lamp floodlight, built-in 13A socket outlet	White or cream, black hob	£65 10 0
Thermostatic	One 8in solid 1,800 W "Simmerstat" control	Grill boiler 2,000 W	6⅞×17×17⅞	5⅞×16⅜×17⅜	Heated drawer (400 W) £3 10 0 extra, non-heated £1 17 6 extra	Auto-timer control unit £7 10 0 extra. Radiant 8in plate £1 15 0 extra	White or two-tone cream, red handles	£31 5 0
Thermostatic	One 8in solid 1,800 W "Simmerstat" one 6½in solid 1,000 W three heat	Grill boiler 2,000 W	6⅞×17×17⅞	5⅞×16⅜×17⅜	Heated drawer (400 W) £3 10 0 extra, non-heated £1 17 6 extra	Auto-timer control unit £7 10 0 extra. Radiant plates £1 12 6 (6½in) and £1 15 0 (8in) extra	White or two-tone cream, red handles	£33 15 0
Thermostatic	One 8in solid 1,800 W and one 6½in solid 1,000 W three heat	Grill boiler 2,000 W	6⅞×17×17⅞	5⅞×16⅜×17⅜	Heating element for drawer (400 W) £1 10 0 extra	Auto-timer control unit £7 10 0 extra. Radiant plates and "Simmerstats" extra	White or two-tone cream	£43 4 6
Thermostatic	One 8in solid 1,800 W three heat or "Simmerstat" control	10½×8in solid 2 kW grill boiler	5×19×15	—	—	Extra wide oven, glass door 10s extra	Cream with black hob or two-tone colours £1 extra	£28 10 0 (leg) £30 0 0 (plinth)

Manufacturer	Name or Model	Type	Size (H.W. & D. in inches)	Oven Type	Oven Size (H.W. & D. in inches)	Oven Loading	Type of Element	Oven Control
CARRON COMPANY, Carron, Falkirk. *(continued)*	L.3	Vertical, legs or plinth	36×22×21	Fixed with single element in bottom	12⅜×14⅞×14	2,400 W	Plug-in special finned sheathed type	Thermostatic
ENGLISH ELECTRIC CO., LTD., Queens House, Kingsway, London, W.C.2.	2009D	Plinth	36×22×23½ (plus 6½in splashplate)	Fixed, removable element guards	14×13¾×15½	2,800 W	Two plug-in spirals and two rod type	Thermostatic
	2011	Plinth	52½×22×24 (36in to top of hob)	Fixed, removable element guards	14×13¾×15½	2,800 W	Two plug-in spirals and two rod type	Thermostatic
	2020	Plinth, raised oven	61×25½×26 (30in to top of hob)	Fixed, removable element guards	14⅜×14½×13⅛	2,500 W	Two banks of spirals and two rod type	Thermostatic
FALCO ELECTRICAL APPLIANCES, LTD., Corporation Road, Audenshaw, Manchester.	"Royal"	Vertical, plinth	49×23×23½ (36in to top of hob)	Removable (5-piece)	16½×17½×15⅜	3,500 W	Inconel sheath plug-in	Thermostatic or auto-timer
	"Freedom"	Vertical, plinth	36×22⅛×19¼	Removable (3-piece)	13×13×14⅜	2,400 W	Plug-in ceramic	Thermostatic or auto-timer
	16B	Vertical, plinth	36×22⅜×19⅛	Removable (3-piece)	13×13×14⅜	2,400 W	Plug-in ceramic	Thermostatic
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.	DC114	Vertical, plinth	44×21×21	Removable (3-piece)	13×13⅛×15¼	2,450 W	Sheathed wire	Thermostatic
	DC756 and DC757	Vertical, legs (DC756) and plinth (DC757)	43¼×18⅛×21	Removable (3-piece)	13¼×13⅜×14⅜	2,425 W	Sheathed wire	Thermostatic
	DC456 and DC457	Vertical, legs (DC456) and plinth (DC457)	43¼×18⅛×21	Removable (3-piece)	13¼×13⅜×14⅜	2,425 W	Sheathed wire	Thermostatic

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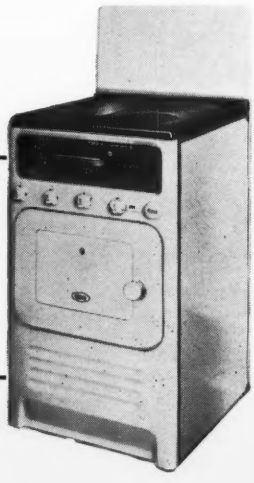

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Hot Plates	Grill or Grill Boiler	Hot Cupboard or Grill Compartment (H.W. & D. in inches)	Storage Drawer (H.W. & D. in inches)	Storage Drawer Loading	Special Features	Finish	Price
One 8in solid 1,800 W one 6½in solid 1,800 W three heat on "Simmerstat" control	10½ × 8in solid 2 kW grill boiler	5 × 19 × 15	—	—	Extra wide oven, glass door 10s extra	Mottled grey	£31 0 0 (leg) £32 10 0 (plinth)
One 8in solid 1·8 kW ("Simmerstat" controlled) and one 6½in solid 1 kW three heat	10½ × 8in 2·5 kW grill boiler (three heat)	5 × 18¼ × 18½	5¼ × 18 × 17⅜	—	Optional glass oven door, cast iron frame	Cream or white	£42 4 0
One 8in solid 1·8 kW and one 6½in solid 1 kW ("Simmerstat" controlled)	10½ × 8in 2·5 kW grill boiler ("Simmerstat" controlled)	5 × 18 × 17¼	5¼ × 18 × 17⅜	—	Plug-in control panel, auto-timer, 4-hr ringer and 13 A shuttered outlet	Cream or white	£61 10 0
Two 8in radiant 1·8 kW each and one 6½in radiant 900 W ("Simmerstat" controlled)	13 × 8in 2·5 kW grill in oven ("Simmerstat" controlled)	6½ × 22 × 15¾ (400 W)	13¾ × 22 × 24 (storage cupboard)	—	Grill "booster" control for rapid oven pre-heating, auto-control oven and hot cupboard	Cream or white	£70 0 0
Two 8in radiant 1·7 kW each one 6½in radiant 900 W "Simmerstat" control	3 kW grill "Simmerstat" control	4 × 17½ × 16	—	—	13A kettle plug, auto-timer and floodlight in splashplate	White, cream, pastel blue and pastel green	£76 13 0
One 8in solid 1·8 kW "Simmerstat" control one 6½in solid 1 kW three heat	10½ × 8 grill boiler solid 2 kW	5 × 18 × 13½	5½ × 16½ × 17 (unheated)	—	Auto-timer warning pinger radiant plates and additional "Simmerstats" optional extras	Cream or white with cream, white or black hob	£49 5 0
One 8in solid 1·8 kW one 6½in solid 1 kW three heat	10½ × 8 grill boiler 2 kW	5 × 18 × 13½	5½ × 16½ × 17 (unheated) optional extra	—	Drop-down door, self-indicating switch knobs, Radiant plates and additional "Simmerstats" optional extras	Cream, green and cream, white with cream, white or black hob	£35 12 6
One 8in solid 1·8 kW "Simmerstat" controlled one 6½in solid 1 kW three heat	10½ × 8in grill boiler 2 kW	6½ × 17¾ × 18½	5¾ × 13¼ × 20	400 W	Drop-down oven door, auto control panel £12 15 0 extra	Green and cream, two-tone ivory or white	£39 18 0
One 8in solid 1·8 kW "Simmerstat" controlled one 6½in solid 1 kW three heat	10½ × 8in grill boiler 2 kW	6 × 11¾ × 16⅝	—	—	Auto control panel £10 extra	Honeysuckle or gleaming white	£31 0 0 (DC756) £32 10 0 (DC757)
One 8in solid 1·8 kW "Simmerstat" controlled	10½ × 8in grill boiler 2 kW	6 × 11¾ × 16⅝	—	—	Auto control panel £10 extra	Honeysuckle or gleaming white	£28 10 0 (DC456) £30 0 0 (DC457)

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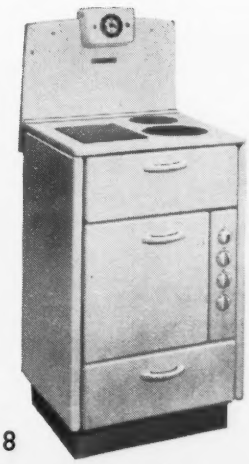

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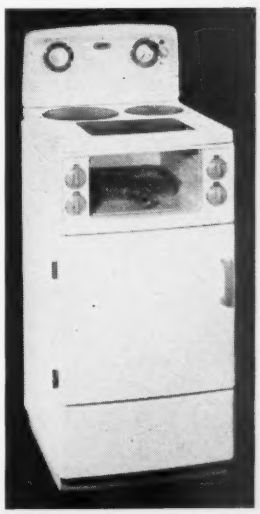
4. English Electric 2020
5. English Electric 2011
6. Carron L.3 plinth model
7. Falco "Royal"
8. Falco "Freedom"
9. G.E.C. DC757 plinth model



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Manufacturer	Name or Model	Type	Size (H.W. & D. in inches)	Oven Type	Oven Size (H.W. & D. in inches)	Oven Loading	Type of Element	Oven Control
L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, London, W.C.2.	LGH600 "Ovenette"	Portable	8×14 diameter	—	—	700 W	Annular channel heating	—
C. HOUNSLOW & CO., LTD., Chalex Works, Southwick, Sussex.	"Regal"	Breakfast	7×9½×12½	—	4×11×8	—	—	—
	"Chalex"	Table	7¾×17×11¼	—	6¼×11½×10½	—	Wide porcelain	Three heat
	"Chalex Bijou"	Table or on stand	19×13×13	Fixed	9×11×11⅝	1,250 W	Wide porcelain	Three heat, two switches
JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, London, S.W.1.	69 "Giant"	Table	16×18×18¼	Fixed	8⅜×10×13¼	1,100 W	Tubular sheathed (base) spirals (top)	Thermostatic
	192J	Vertical, plinth, drawer	44½×21×17⅜ (36in to top of hob)	Removable element guards	12⅝×12½×16½	1,780 W	Plug-in spirals in ceramic tubes	Thermostatic
	194J	Vertical, plinth, drawer	44½×21×21 (36in to top of hob)	Removable element guards	12⅝×12½×16½	2,100 W	Plug-in spirals in ceramic tubes	Thermostatic
	"Two-Ninety"	Vertical, legs	42½×23 7/16×17⅜ (36in to top of hob)	Removable element guards	12⅝×12½×13¾	1,780 W	Plug-in spirals in ceramic tubes	Thermostatic
	"Two-Nine-Three"	Vertical, legs	44×23½×25½ (36in to top of hob)	Removable element guards	12⅝×12 7/16×16½	2,100 W	Plug-in spirals in ceramic tubes	Thermostatic
	390J	Vertical, leg, plinth, drawer	45×20½×21½ (36in to top of hob)	Removable element guards	14¼×13½×15⅝	2,500 W	Tubular sheathed	Thermostatic
	391J	Vertical, leg, plinth, drawer	45×20½×21½ (36in to top of hob)	Removable element guards	14¼×13½×15⅝	2,500 W	Tubular sheathed	Thermostatic
REVO ELECTRIC CO., LTD., Tipton, Staffs.	"Revomatic"	Vertical, plinth	53⅜×23×24 (36in to top of hob)	Removable	14×15⅝×13¾	2,100 W	Sheathed	Thermostatic

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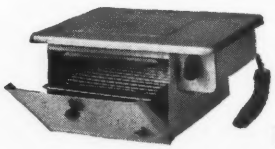

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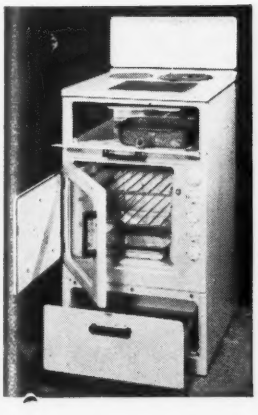
Hot Plates	Grill or Grill Boiler	Hot Cupboard or Grill Compartment (H.W. & D. in inches)	Storage Drawer (H.W. & D. in inches)	Storage Drawer Loading	Special Features	Finish	Price
—	Grilling can be done in oven	—	—	—	Viewing cooking window, capacity increasing collar 10s extra	Aluminium	£4 9 6
—	9×7in 750 W grill boiler	—	—	—	—	Grey mottled stoved enamel	£2 15 10
—	10×8in 1·8 kW grill boiler	—	—	—	—	Grey mottled stoved enamel	£6 17 10
One 5½in 750 W	—	—	—	—	—	Grey mottled stoved enamel	£9 0 7
One 7in radiant (" Simmerstat " controlled)	Grill in top of oven 800 W	10⅛×5½×13½	—	—	Stand complete with potshelf £1 16 6 extra	Cream and black or white and black	£18 2 6
One 8in solid 1·8 kW (three heat)	10½×8in 2 kW grill boiler	4½×18×13¾	6×16¼×14½	400 W	Glass oven door. Auto-control unit, radiant hotplates and " Simmerstats " extra	Two-tone ivory or all-white	£36 15 0 (cold drawer) £38 15 0 (heated drawer)
One 8in solid 1·8 kW one 6½in solid 1 kW (three heat)	10½×8in 2 kW grill boiler	4½×18×18⅛	6×16¼×19	400 W	Glass oven door. Auto-control unit, radiant hotplates and " Simmerstats " extra	Two-tone ivory or all-white	£41 10 0 (cold drawer) £43 10 0 (heated drawer)
One 8in solid 1·8 kW (" Simmerstat " controlled)	10½×8 2 kW grill boiler	5⅜×17½×11	6½×17½×14½ (unheated)	—	Towel rails, rollers on back legs. Radiant hotplates and " Cookalone " auto-control unit extra	Cream with green legs, white with grey legs or all-cream	£28 10 0 (legs) £30 5 0 (drawer)
One 8in solid 1·8 kW (" Simmerstat " controlled) one 6½in solid (three heat)	10½×8 2 kW grill boiler	4⅜×17½×16½	6⅜×17½×17½ (unheated)	—	Towel rails, rollers on back legs. Radiant hotplates, " Simmerstats " and " Cookalone " auto-control unit extra	Cream with green legs, white with grey legs or all-cream	£31 0 0 (legs) £32 15 0 (drawer)
One 8in solid 1·8 kW (" Simmerstat " controlled)	10½×8in grill boiler 2 kW	14⅞×12½×17½	8⅜×17½×14½ (unheated)	—	" Cookalone " auto-control unit and radiant hotplate extra	All cream or all white	£28 10 0 (legs) £30 0 0 (plinth) £31 15 0 (drawer)
One 8in solid 1·8 kW (" Simmerstat " controlled) one 6½in solid 1 kW three heat	10½×8in grill boiler 2 kW	14⅞×12½×17½	8⅜×17½×14½ (unheated)	—	" Cookalone " auto-control unit and radiant hotplates extra	All cream or all white	£31 0 0 (legs) £32 10 0 (plinth) £34 5 0 (drawer)
One 8in solid and one 8in radiant 1·8 kW each, (" Simmerstat " controlled)	16×8 grill boiler 3 kW	5½×16¾×20	4×17⅜×16½ (unheated)	—	Choice of five separate coloured hobs	Cream or white with black, grey or two-tone ivory hobs	£69 6 0



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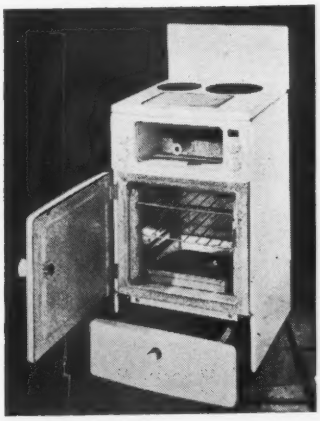

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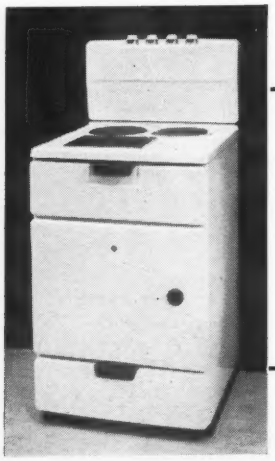
10. *Revo " Revomatic "*
11. *Hounslow " Chalex "*
12. *L. G. Hawkins " Ovenette "*
13. *G.E.C. DC114*
14. *Jackson 194J*
15. *Jackson 390J*

Manufacturer	Name or Model	Type	Size (H.W. & D. in inches)	Oven Type	Oven Size (H.W. & D. in inches)	Oven Loading	Type of Element	Oven Control
REVO ELECTRIC CO., LTD., Tipton, Staffs. (*continued*)	" Regal "	Vertical, plinth	48¾ × 23 × 24 (36in to top of hob)	Removable	14 × 15⅜ × 13¾	2,100 W	Sheathed	Thermostatic
	" Regent " 552	Vertical, legs or plinth	45 × 21 × 21½ (36in to top of hob)	Removable	13½ × 13¾ × 14	2,100 W	Sheathed	Thermostatic
	" Regent " 553	Vertical, legs or plinth	45 × 21 × 21½ (36in to top of hob)	Removable	13½ × 13¾ × 14	2,100 W	Sheathed	Thermostatic
	" Peerless "	Table or on stand	17¾ × 21 × 15½	Fixed	12¼ × 11⅝ × 13	Grill: 2,000 W Bottom: 900 W	Spiral on ceramic former	Thermostatic
SIMPLEX ELECTRIC CO., LTD., Creda Works, Blythe Bridge, Staffs.	E.V.13	Vertical	36 × 21 × 19½	Fixed, removable sides and base	13¾ × 13 × 13½	2,500 W	Tubular sheathed	Thermostatic
	" Carefree "	Vertical	53½ × 21 × 25 (36in to top of hob)	Fixed, removable sides	15⅛ × 14 × 14½	2,500 W	Tubular sheathed	Thermostatic
	" Stargazer "	Vertical	51¼ × 18½ × 20½ (36in to top of hob)	Fixed, removable sides	13¾ × 12⅝ × 14⅝	2,200 W	Tubular sheathed	Thermostatic
TRICITY COOKERS, LTD., 109, Kingsway, London, W.C.2.	528	Vertical	36 × 19¾ × 16	Fixed	10½ × 11⅞ × 12¼	1,150 W	Coil former	Thermostatic
	" Queen " 535	Vertical	52 × 22 × 22 (36in to top of hob)	Fixed	14¾ × 15¾ × 14½	2,490 W	Plug-in tubular	Thermostatic
	" Coronet " 550	Vertical	44 × 20¾ × 21¼ (36in to top of hob)	Removable sides	10½ × 11½ × 12¼	1,150 W	Coil former	Thermostatic
	" Trivet " 555	Breakfast	10 × 19½ × 11	—	—	—	Spiral	—
WARNFORD CONSTRUCTIONS, LTD., 1, Chesterfield Street, London, W.1.	" Mastercook "	Breakfast	9 × 8 × 4	—	—	750 W	Protected	—



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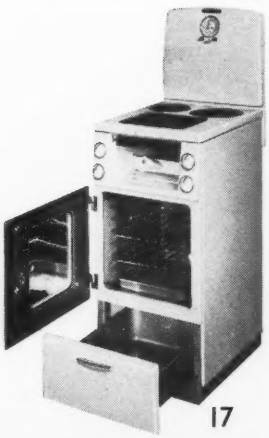
16. *Revo " Regal "*
17. *Simplex " Creda Stargazer "*
18. *Tricity " Queen " 535*
19. *Tricity " Coronet " 550*
20. *Simplex " Creda Carefree "*



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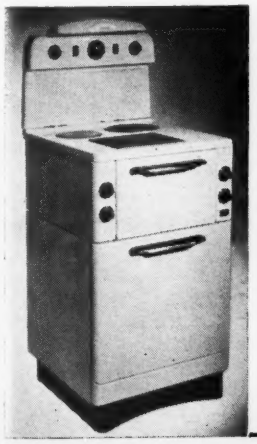
Hot Plates	Grill or Grill Boiler	Hot Cupboard or Grill Compartment (H.W. & D. in inches)	Storage Drawer (H.W. & D. in inches)	Storage Drawer Loading	Special Features	Finish	Price
Two 8in solid 1·8 kW each one "Simmerstat" controlled, one three heat	10½×8 grill boiler 2·2 kW	5½×16¾×20	4×17⅞×16½ (unheated) optional extra	—	Choice of five separate coloured hobs	Cream or white with coloured hobs	£36 5 0
One 8in solid 1·8 kW "Simmerstat" controlled	10½×8 grill boiler 2·2 kW	5×13×19	—	—	Utensil compartment, choice of coloured hobs	White with black hob, two-tone ivory, white and pearl grey	£28 10 0 (legs) £30 0 0 (plinth)
One 8in solid 1·8 kW "Simmerstat" controlled one 6¼in solid 1 kW three heat	10½×8 grill boiler 2·2 kW	5×13×19	—	—	Utensil compartment, choice of coloured hobs	White with black hob, two-tone ivory, white and pearl grey	£31 0 0 (legs) £32 10 0 (plinth)
One 6¼in solid 1 kW "Simmerstat" controlled	10×7 grill boiler 2 kW	10¼×7×13	—	—	Suitable for 13A outlet. Radiant hotplate extra	Black and cream	£19 9 0 (table) £21 7 6 (with stand)
One 8in solid 1·8 kW one 6¼in solid 1 kW three heat	10½×8 grill boiler 2 kW	4½×17½×13½	7⅛×16⅜×17	400 W	Glass oven door £1 15 0 extra	Two-tone ivory	£36 14 0
One 8in solid 1·8 kW "Simmerstat" controlled one 6¼in solid 1 kW three heat	10½×8 grill boiler 2 kW	4½×17½×12½	7⅛×17×15½	400 W	Time clock, illuminated hob. Glass door £2 10 0 extra	Cream	£50 0 0
One 8in solid "Simmerstat" controlled 1·8 kW one 6¼in solid 1 kW three heat	10½×8 grill boiler 2 kW	4⅜×11⅞×17	7×13½×17¾ (unheated)	—	Glass door standard, storage drawer £1 15 0 extra Timer control splashplate £8 0 0 extra	Cream	£32 10 0
One 6¼in solid 1 kW three heat	10½×8 grill boiler 2 kW	4×11½×12½	—	—	Selector switch enables cooker to be used off 13/15A circuit	Ivory or white	£22 16 6
One 8in radiant 1·7 kW one 6¼in solid 1 kW "Simmerstat" controlled	Grill boiler 2·25 kW "Simmerstat" controlled	7×13×16	—	—	Auto-timer control, 13A socket outlet	Ivory or white, maroon handles and knobs	£68 5 0
One 8in solid 1·8 kW "Simmerstat" controlled	Grill boiler 1·8 kW	4½×12×12	—	—	Auto-control panel £7 7 0 extra. Tailored ovenware £2 3 0 extra plus 9s 6d P.T.	Ivory or white	£27 5 0
—	Grill boiler 2·25 kW	5½×11×10	—	—	Suitable for use in dining room	Grey doors, white hob, endplates in choice of four colours	£12 0 0
—	6×5 grill boiler	2×7½×6	—	—	Glass grill pan, aluminium toast shelf	Polished aluminium	£3 7 6



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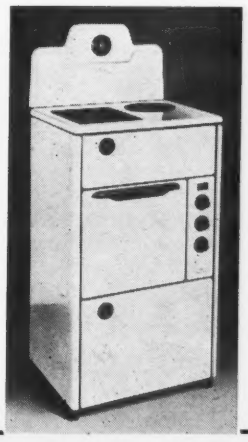

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World Electrical Markets

Comparison of Principal Suppliers

By R. E. KAAN, Dipl. Ing.

THE further application of electricity to the welfare of mankind has considerably increased during the last year and, with it, electrical world trade as will be seen from Table 1 and Fig. 1.

Great Britain's electrical manufacturing industry reached a new record of £245.3 million last year, representing an increase of 12 per cent over the 1954 figure. During the first four months of this year there was an encouraging increase of 10 per cent, against the comparable figure for 1955 (Fig. 2). But still the industry barely managed to maintain its share in world electrical exports as shown in Table 2; Western Germany not only managed to increase her exports by 24 per cent, but also her percentage share of world electrical exports.

Factors contributing to the temporary decline of the British share of world electrical exports included a further increase of foreign competition in overseas markets, imposition of import restrictions, establishment of local manufacture, and in many cases the fixing of unacceptable prices and payment conditions by foreign purchasing organisations. By far the most important factor is price and with it the question of extended credits. Low prices quoted by some Continental competitors are part of a campaign designed to extend their business in traditional British markets and to gain footholds in territories hitherto closed to them.

The United States, and also Western Germany rely upon a huge still unsatisfied home market, which indirectly supports their exports, and puts them in the enviable position of being able to choose certain interesting projects where repeat orders can reasonably be expected. Competitors' prices are therefore in many cases fixed to suit each individual project, varying in value according to the territory, the keenness of the supplier to book the order and the willingness of the customer to forgo in many cases quality and durability for price.

The British electrical manufacturer is witnessing the start of a trade rivalry hitherto unknown. Therefore the necessity arises more than ever to seize all opportunities in Continental Europe, the Middle East, and once the embargo on strategic exports is lifted, in Russia and the vast markets of China.

Among the Continental competitors, **Western Germany** whose electrical industry, as in former years, showed a remarkable expansion during 1955, is by far the most formidable. The significance of her steady export expansion is shown in Table 3.

Table 1.—World Electrical Exports, 1955

Country	Value	Per cent incr. over 1954
	(£ million)	
United Kingdom	245·3	12·0
Austria	7·4	26·0
Belgium	29·5	30·0
Canada	11·8	1·0
Denmark	11·1	26·0
France	51·2	8·0
Holland	65·3	17·0
Italy	11·5	1·0
Japan	8·2	23·0
Norway	1·5	50·0
Sweden	22·9	8·0
Switzerland	24·6	1·0
United States	302·1	17·0
W. Germany	175·4	24·0
Rest of world	15·4	0·2
World Total	973·2	14·0

Table 2.—Share of World Electrical Exports (per cent)

Country	1953	1954	1955
United Kingdom	25·7	25·7	25·2
United States	34·5	30·0	31·3
Western Germany	12·6	16·6	18·1
Rest of world	27·2	27·7	25·4

Table 3.—Western Germany's Electrical Exports, 1951-56

Year	Value	Per cent Increase
	(£ million)	
1951	56·3	71
1952	89·9	60
1953	105·3	18
1954	141·3	35
1955	175·4	24
1956 (first 4 months)	63·9	25

Table 4.—French Electrical Exports, 1953-1955
(Values in £ million)

	1953	1954	1955
Other countries	16·7 (1·9)	21·1 (2·2)	27·5 (2·3)
Overseas possessions	23·2 (4·5)	23·4 (4·3)	23·7 (4·4)
Total	39·9	44·5	51·2

Note:—The percentage of total exports is given in parentheses.

Economic indicators leave little doubt, that the boom in the Federal Republic during the past few years is being fully maintained. The pattern of development is suggested by the annual reports of the big concerns, the rate of expenditure on rationalisation of production methods, and the success of the last Hanover Fair. This state of affairs is more remarkable inasmuch as during the past year the home demand greatly increased, thus weakening to some extent incentives to export, especially since the cessation of rediscount privileges which export bills had enjoyed until the end of the year 1955.

The increasing expansion in the Central Banking System's lendings to other banks rose from the equivalent of £220 million at the end of August, 1955, to £380 million at the end of April this year, and has been followed by a recent reduction of the banks' capacity to grant credits. The credit restrictions so far applied have already made it appreciably more difficult to ensure finance for capital projects overseas, and reports of lost orders on this account are increasing.

But on the whole, these restrictions by themselves have not been drastic enough to check the ever-turning wage-price spiral. Whether the alternative solution put forward by Western Germany's champion of free enterprise, Herr Erhardt—the reduction of all import duties in order to keep a steady price level at home—will be successful remains to be seen. Shortage of skilled labour and certain raw material and supply difficulties for the electrical industry add to the increasing problem of production expansion.

Though in common with other Soviet satellite countries official **East German** trade accounts are unavailable, there are indications, that the State-owned combines, including those of Russia herself, in some cases

succeeded in launching intensive economic offensives directed mainly towards the Middle- and Far East. Under the latest East German five-year plan, 67 per cent of exports will consist of machinery, against 60 per cent last year, with the accent on complete plants. The aim is to increase trade with the West by 70 per cent by 1960.

Belgium during the last year managed to give a considerable boost to her already increasing exports during last year, and again proved a successful competitor particularly in heavy plant and transformers.

The main reasons for Belgian export progress are: Willingness of the manufacturers to comply fully with the customers' requirements, intensive market research, extended credits, extremely competitive price levels, short delivery periods and competent after-sales service.

France's electrical exports are mainly directed to her possessions abroad and to neighbouring Continental countries. Table 4 shows the distribution of exports between French possessions abroad and other countries.

The most common form of export subsidising by industry itself by maintaining home prices at such levels as to allow lower quotations for exports, is successfully applied by **Switzerland.** The fact that the German subsidiary of Brown-Boveri in many cases works in close collaboration with its Swiss headquarters by allocating work according to free capacity, has proved of the utmost importance in securing overseas orders. Steam and hydro-electric plant and distribution materials account for the bulk of Swiss electrical exports.

Substantial home orders for heavy equipment at a favourable price level in connection with the extension of her power production and grid system, has enabled the electrical industry of **Italy** to work at full capacity and to keep its electrical exports at a steady level of about £11.5 million.

Italy sent her electrical exports to neighbouring countries in Europe and overseas to South America, India, Pakistan, Egypt and Australia. Heavy plant and distribution material accounted for most of the trade (Table 5), but telecommunications equipment was also exported to a considerable extent.

Whether the recently introduced regulations regarding the disposal of foreign currencies accruing to exporters will have any effect on her exports remains to be seen. United Kingdom exports to Italy, which has proved an important market, increased from £3.6 million in 1954 to £4.2 million last year, with domestic appliances in the lead.

Table 5.—Italian Electrical Trade, 1953-54
(£ million)

Group	1954		1955	
	Imports	Exports	Imports	Exports
Rotating machinery	3·7	3·5	2·7	3·3
Distribution material	4·9	3·5	6·5	3·5
Telecomm. equipment	5·6	3·7	6·6	4·7
Total	14·2	10·7	15·8	11·5

Table 6.—Sweden's Electrical Exports, 1955-54 (£000)

Product Groups	1954	1955
Steam turbines	1,413	1,121
Water turbines	775	701
Generators, motors and convertors	4,172	4,301
Starting and regulating gear, safety appliances ...	1,374	1,481
Mercury-arc rectifiers, condensers, welding equip., ovens and relays	3,130	2,431
Telephone and telegraph app.	6,215	6,823
Radio receiving app.	786	1631
Ventilators, vacuum cleaners and floor polishers ...	3,712	3,321
Accumulators	1,251	1,031
Insul. cables and wires	682	923

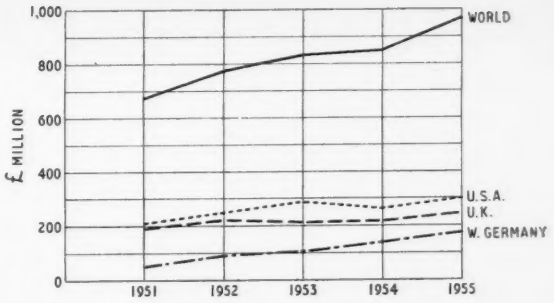


Fig. 1.—World electrical exports 1951-1955.

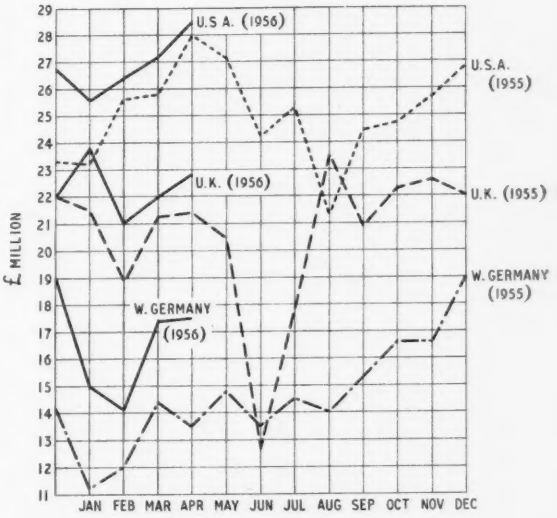


Fig. 2.—Monthly electrical exports 1955-1956.

Italy, which gave a lead in the "liberalisation" of trade in Europe through the O.E.E.C., has applied this process to the bulk of her imports, including electrical products.

Though **Sweden's** electrical exports remained practically at the 1954 level, her main electrical exporters, A.S.E.A. and Ericsson, were very successful in many cases in overseas markets. A.S.E.A.'s main electrical exports during last year included prime movers and power transformers. In spite of substantial orders in connection with power developments in North Sweden, new industrial projects, and the extension of Stockholm's "Underground," this firm exported 21 per cent of its output. Details of Sweden's chief electrical exports are given in Table 6.

Another formidable competitor of the United Kingdom electrical manufacturers of electronics and telecommunication material is **Holland,** which managed in spite of shortage of skilled labour, rising prices, and claims for shorter working hours to increase her electrical exports by 17 per cent and now ranks fourth among the world electrical exporters (see also article on Holland's electrical trade in the *Electrical Review* of 1st June, 1956).

Austria's electrical industry, represented by her four main manufacturers of heavy gear, and supported on the electronic side by the local subsidiary of Philips, increased its exports by 26 per cent. This steep increase is due to the full resumption of trade relations after the signing of the peace treaty. Though the Austrian economy is still in a stage of transition, there are potential

openings for United Kingdom manufacturers of domestic appliances and television equipment.

Japan's electrical exports increased from £6.6 million in 1954 to about £8.2 million last year. With the cessation of hostilities in Korea, one of Japan's main markets returned. Japanese competition is encountered even in such traditional United Kingdom markets as India, Pakistan and Burma on the heavy electrical side, and for porcelain insulators. Reciprocal missions between Japan and under-developed countries in the Far East and a series of new manufacturing agreements concluded with American and Continental firms have helped to boost her manufacturing capacity and output.

The world's biggest exporter of electrical goods and apparatus, the **United States,** had a very prosperous year in 1955. Its electrical manufacturers are able to sell about 90 per cent of their output on the still unsaturated home market; they can quote extremely keen prices overseas, particularly for mass-produced domestic appliances, and in some cases for heavy equipment. As in former years, Canada was the United States' main market, followed by the South American countries. The trend of her electrical exports in these territories is set out in Table 7.

Table 7.—U.S. Electrical Exports, 1955-54 (£000)

Country	1954	1955	Country	1954	1955
Canada	70,100	87,501	Panama	733	77(
Argentina	2,810	1,867	Bolivia	334	51
Brazil	12,517	6,001	Mexico	11,970	12,80
Uruguay	723	1,100	Paraguay	155	5(
Venezuela ...	14,172	13,727	Peru	2,515	2,95
Colombia	10,422	9,375	Ecuador	988	87(
Guatemala ...	720	1,033	Chile	1,421	1,16
Nicaragua	741	675	India	2,187	2,19
Costa Rica ...	1,090	943	Pakistan	285	63
Cuba	8,372	10,097	Australia	1,532	1,77

In order to maintain Great Britain's position as the world's second largest supplier of electrical requirements, the British manufacturer will have to continue to quote for every project, irrespective of size, particularly in the traditional markets.

Electricity in South Africa

FROM OUR CAPE TOWN CORRESPONDENT

THE Cape Town city electrical engineer recently mentioned that tenders for the main plant and equipment for the city's new power station at Athlone had to be deposited at Electricity House, Cape Town, by 21st August, and would be opened in public in the city hall the same day. The building of the new power station, which he hoped would be finished by the winter of 1960, involved 25 different contracts, for seven of which tenders were being invited. The first contract—for an investigation of the nature of the soil on the 100-acre site at Athlone—had already been placed.

The Dunswart Iron and Steel Works, Ltd., Benoni, Transvaal, has been equipped with two 10-ton and one 5-ton electric arc furnaces. The power required for the operation of each arc furnace is taken from a 6·6 kV supply. An A.E.G. arc furnace transformer of 4,000 kVA rated capacity provides the necessary low voltage for the arcs. The adjustment of the various low voltages is accomplished by means of an off-load tap changer, remote controlled from the control panel or manually controlled. To limit current surges during the melting period a reactor is incorporated in the h.t. side of the transformer, which is short circuited during the refining. The electrode contactless-motor regulation for the furnaces is fully automatic so that no attention is necessary after the initial starting up.

Regulations to compel owners of electrical apparatus which cause interference with radio reception to fit suppressors are to be issued. Details of the regulations are not yet known, but they will probably be based on those in Great Britain, and they will come into force on 1st January next.

In its tenth annual report the South African Bureau of Standards states that the electrical engineering division completed additional work in the standardisation of technical terms for the electrical engineering industry. Work on the English terms was done in conjunction with the International Electrotechnical Commission and a start was also made on the Afrikaans nomenclature. Here, also, the I.E.C. rendered valuable assistance by providing standard lists of equivalent terms in Dutch and German.

Switchcraft (Pty.), Ltd., Johannesburg, who produce switchboards, and an associated company, Lite Electrical Switch Manufacturers (Pty.), Ltd., who make switches and small electrical requirements, are now operating in a much larger factory at Kew, Johannesburg. With a floor area of about 40,000 sq ft this factory is now one of the largest of its kind in South Africa, and the older factory was redesigned and partly rebuilt to allow for the introduction of the latest manufacturing techniques. This company has been making switches in the following range: 30 A double pole; 60 A double pole; 60 A triple pole; and 100 A double pole. The latest addition to this range of Class A switches are the 200 A double pole and the even more recent 30 A triple pole. These switches are of a sufficiently wide range to meet most of the South African requirements. The factory is producing in quantity standardised three-phase switchboards, the product of careful research into the South African electrical industry. It is now estimated that only about 10 per cent of switchboard needs are not covered by this range of manufacture, this 10 per cent consisting of the more specialised types that would have to be made to order.

Continuous Steel Casting

MILD steel billets of commercial quality are now being produced in a pilot continuous casting plant at Barrow Steel Works, Ltd., at higher casting speeds than have been attained on any other known plant of this kind. The Rossi-Junghans machine at Barrow, on which extensive development work has been carried out over the past three years, is operating at speeds in excess of 200in per minute—the equivalent of 7 tons of 2in square steel billets per hour. The pilot plant at Barrow is capable of producing billets from 2in to 4in square and slabs of up to 6in by 2in in cross-section. Satisfactory results have been achieved in the continuous casting of mild steels, low alloy steels and stainless steels.

Carbon and alloy steels for continuous casting are melted down and refined in a 5-ton electric arc furnace. After tapping, the ladle of molten steel is teemed into a " tundish " at the top of the continuous casting plant, and the steel then flows at a controlled rate into a reciprocating water-cooled copper mould. A partly solidified billet, with its central core still liquid, is withdrawn from the bottom of the mould, and solidification is completed as the billet, preceded by a dummy billet, travels vertically down the machine. When it emerges in solid form, the continuously cast billet is cut to the required lengths.

In subsequent manipulation, the continuously cast carbon steels have been found to have good forging characteristics, while high quality sheets have been rolled from continuously cast stainless slabs. Experiments are continuing with a view to establishing a satisfactory process which will be both economic and repetitive.

NEW ELECTRICAL EQUIPMENT

H.F. Hardening of Lawn Mower Blades

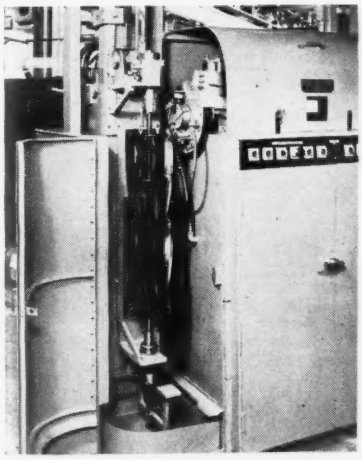
To meet the need for rapid and accurate hardening of helical rotor cultivators, the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, has developed, in conjunction with Ransomes, Sims & Jefferies, Ltd., a new h.f. induction heating machine for hardening the blades of lawn mower cylinders. The main features of the machine, which is installed in Ransomes' Ipswich works, are speed of operation, accuracy of results, and a high degree of flexibility.

The machine is designed for use in conjunction with an electronic high-frequency generator with an output of 25/50 kW, operating at a frequency of 0·4 Mc/s. It has two work stations which may be operated independently and is so arranged that one station can be loaded or adjusted while the other is working. Two identical carriages operate on vertical guide-ways and each carriage can be loaded with cylinders 5in to 11in diameter, 12in to 36in length, having blade thickness ranging from $\frac{1}{8}$in to $\frac{1}{4}$in.

Vertical Pumps

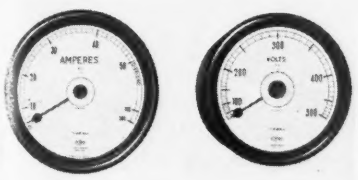
A range of vertical pumps for pressures up to 350 lb/sq in is offered by RHODES, BRYDON & YOUATT, LTD., Waterloo Engineering Works, Gorsey Mount Street, Stockport. The main attractions of this vertical construction are compactness, as they take only a fraction of the floor space required by a corresponding horizontal pump; ease of access to working parts; reduced overall length; increased rigidity of the pump end; and simplified stuffing box sealing.

The casing is of cast steel with suction and delivery branches in line and on a common centre height but offset from the axis of rotation. The impeller is of the conventional, single entry, double shrouded type manufactured in zinc-free bronze or spheroidal graphite cast iron according to specific requirements.



Above: B.T.H. two-station lawn-mower cylinder hardening machine

Below: "Circscale" moving iron meters



Withdrawable Type Switchgear

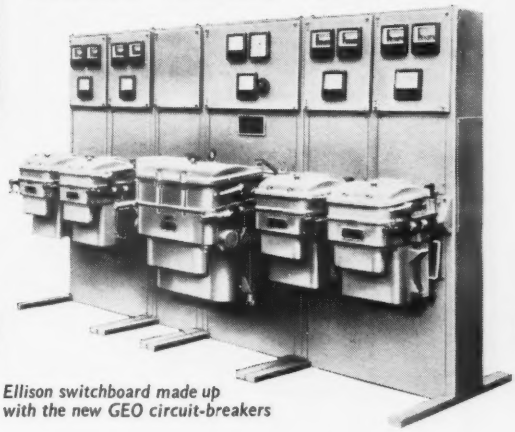
A new range of medium voltage, withdrawable type electric switchgear, to be known as the GEO Range, is announced by GEORGE ELLISON, LTD., of Perry Barr, Birmingham. The new switchgear comprises horizontally isolated drawout circuit-breakers for service voltages of up to 660 and with carrying capacities of 400, 600, 800 and 1,200 A.

The breakers are mounted on busbar chambers of exceptionally robust construction throughout, and have been A.S.T.A. tested in accordance with B.S. 116: 1952 at 600 V. The breaking capacities range up to 45 MVA at 600 V, with 1,200 A current rating. The fixed main contacts and the fixed and moving arcing contacts are identical throughout the range, varying only with the number of arcing contacts fitted to each size of breaker. Auxiliary switches may be easily fitted to the circuit-breaker within the oil tank, below the level of the oil.

Redesigned Meters

The RECORD ELECTRICAL CO., LTD., Broadheath, Altrincham, Cheshire, have now gone into production with redesigned "Cirscale" moving iron ammeters and voltmeters. These have an angular deflection of 240 deg (approx.) obtained entirely without gearing by a combination of the "attraction" and "repulsion" principles. The maximum permissible errors at calibrated frequency (normally 50 c/s) and temperature between 20 and 100 per cent of full scale deflection are, in terms of full scale value: voltmeter ±1·0 per cent, ammeter ±1·5 per cent.

The cases are of heavy gauge pressed steel and are made either round projecting, round flush or square flush as required. Hermetically sealed cases in die-cast aluminium alloy are also available to meet tropical conditions. Milliammeters are supplied in ranges from 10 mA, ammeters up to 20 A, and voltmeters from 10 V up to 600 V; 4in or 6in dials are available.



Ellison switchboard made up with the new GEO circuit-breakers

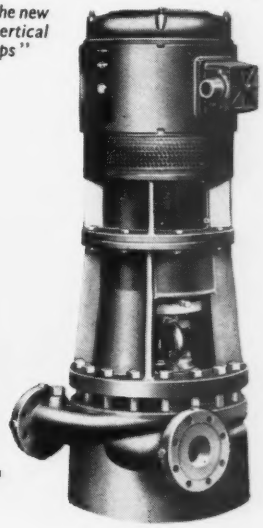
Strip Chart Recorder

A strip chart potentiometer recorder with a pen speed of $\frac{1}{4}$ sec full scale travel has recently been introduced by HONEYWELL-BROWN, LTD., 1, Wadsworth Road, Perivale, Middlesex. The electronic null-balance servo measuring system incorporates a newly designed "plug in" amplifier with a high input impedance and output power.

The amplifier output drives a new type of balancing motor having a no-load speed of 1,650 r.p.m. The design refinements of the motor, amplifier and slidewire assembly produce a pen speed giving full 11in scale travel in only $\frac{1}{4}$ sec. A tachometer circuit provides damping which is strictly a function of pen speed, and is adjustable by means of a rheostat. The $\frac{1}{4}$ sec recorder is designed to meet the demands of scientists and development engineers who need to record rapidly changing variables.

Full details of the recorder are provided on instrumentation data sheet No. 10.0-21, available from the makers.

Example of the new range of vertical "Mopumps"



Financial Section

STOCKS and SHARES

STOCK EXCHANGE markets have continued to be dominated by the Suez Canal situation. Institutional and other big investors appear to have retreated well inside their shells for the time being, leaving a very small volume of other business to move prices one way or the other in correspondence with the tenor of the news. Markets began this week on a distinctly cautious note, having received no assistance from recent domestic developments, which included the expected reduction in the gold reserves, and the definition of the T.U.C.'s attitude towards wage restraint. Prices were being upheld fairly well, however, and were showing readiness to respond quickly to encouragement.

Price Changes

Now that A.E.I. shares are quoted ex the third quarterly interim dividend, there remains no distinction between them and the new shares issued during the year, and there is now a single quotation. The latter eased further to 70s, having been down to 68s 6d during the week. Reyrolles were 2s 6d better on balance at 116s 3d; the interim dividend for the current year is being raised from 6¼ to 6½ per cent. Telegraph Condensers went back to 41s 3d after the company's advice to shareholders that profits for the first half of this year were materially lower, as forecast in the last report, and that the maintenance of the interim dividend at 5 per cent should not be taken to mean that the total will be up to last year's 25 per cent.

Dubilier Prospects

At the recent annual meeting, the chairman of the Dubilier Condenser Co. reviewed a year in which turnover reached record figures and profits increased, although in less than the same proportion because of the acceptance of smaller profit margins. A reduction in orders from the radio industry had been partially offset by the establishment of new business in electronic, nucleonic and atomic fields. As to prospects, the chairman said that a shorter-term order book was in operation, and some of the plant was not working at full capacity; but sales in the first quarter had been slightly above last year's corresponding figure, and in view of the widened range of business he thought that satisfactory results should materialise. Projects under consideration might call for the raising of fresh capital. The 30 per cent dividend involves the distribution of less than a quarter of the £172,000 net surplus available, and puts the 1s shares, at 4s 6d, on a yield basis of 6·7 per cent.

Vactric's Activities

Vactric 5s ordinary were among the shares to come in for attention in connection with the Farnborough Air Display, where some of the group's equipment was on show. At the annual meeting held in July, the chairman indicated the extent to which activities are being extended beyond the original business in domestic

Price Changes in

Company or Board	Nom. Value	Middle price 10th Sept.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1956 Highest	1956 Lowest
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	73½	−1	3	3	4 1 9	80½	73½
Brit. Elec. 1974/77	100	72½	−1	3	3	4 2 9	79½	71½
Brit. Elec. 1976/79	100	78½		3½	3½	4 9 3	84	77½
Brit. Elec. 1974/79	100	87½		4½	4½	4 17 3	95	87½
Overseas Electric Supply								
Calcutta Elec.	£1	19/6	−6d	6†	6†	6 3 0†	20/9	19/-
East African Power	£1	19/-	−6d	7	7	7 7 3	21/3	19/6
Nigerian Elec.	£1	17/6		10	10*	11 8 6	21/-	17/-
Perak Hydro-Elec	£1	16/-		10	10	—	17/6	14/9
Equipment and Manufacturing								
Aberdare Cables	5/-	12/-		17½	17½	7 5 9	13/6	10/6
Aerialite	1/-	4/9		88½	45*	9 9 6	6/9	4/9
Allen, W. H.	£1	38/9	+1/3	20	10*	5 3 3	39/-	33/6
Aron Elec. Ord.	£1	55/9		15	15	5 7 6	56/-	53/6
Assd. Automation	10/-	17/6		10	5	2 17 3	19/-	17/-
Assoc. Elec. Ord.	£1	70/-x.d.	−1/-	14	15	4 5 9	85/6	57/9
Automatic Tel. & El.	£1	57/6x.d.		15	15	5 4 3	72/6	56/3
Babcock & Wilcox	£1	77/6		15	15	3 17 6	85/6	64/-
Baldwin, H. J.	2/-	5/-		20	20	8 0 0	5/-	3/9
Bakelite	10/-	27/6		16	16	5 16 6	34/-	26/9
Berry's Electric	5/-	6/3		—	10‡	8 0 0	6/6	5/9
British Aluminium	£1	71/3	−1/3	12	12	3 7 6	78/9	40/6
B.I. Callender's	£1	50/-		10	12½	5 0 0	54/3	45/-
B.I. Callender's 6% Pref.	£1	21/9		6	6	5 10 3	22/6	20/3
British Tabulating	£1	48/9		9	9	3 13 9	51/3	37/3
British Thermostat	5/-	25/-		20	25	5 0 0	31/9	24/6
British Vac. Cleaner	5/-	7/-		30	15*	10 14 3	8/9	6/-
Brook Motors	10/-	33/9	+1/3	20	25	7 8 3	44/-	31/9
Brush Group	5/-	6/-		10	10	8 6 9	7/9	5/9
Bulgin, A. F.	1/-	4/9		45	50	—	5/3	4/3
Burco Dean	5/-	8/6		—	22½	13 4 9	13/3	8/3
Chloride El. Storage "A"	£1	62/6x.d.	−9d	17½	17½	5 12 0	73/6	60/9
Clarke Chapman	£1	120/-		20	22½	3 15 0	123/-	89/6
Cole, E. K.	5/-	17/3	−3d	17½	17½	5 1 6	22/3	15/6
Cossor, A. C.	5/-	5/6		15	Nil	Nil	10/3	5/-
Crabtree	10/-	25/-	−1/-	20	20	8 0 0	29/3	25/-
Crompton Parkinson Ord.	5/-	13/3		20	16*	6 0 9	15/-	12/3
De La Rue	5/-	16/6	−3d	30	30	9 1 9	20/3	15/-
Decca "A"	4/-	26/3	−6d	56½	43¾*	6 13 3	44/9	24/9
Desoutter	5/-	31/-x.d.		25	30	4 16 9	32/9	25/9
Dewhurst	2/-	6/-		24	30	—	7/6	5/3
Dictograph Tel.	2/-	5/9		20	20	6 19 3	6/9	5/6
Dubilier Condenser	1/-	4/6		25	30	6 13 3	4/9	3/6
Duport	5/-	18/9		23	25‡	6 13 3	21/6	13/9
E.M.I.	10/-	26/3	−9d	10	15	5 14 3	37/-	25/6
Electrical Components	5/-	13/9		25	25	9 1 9	16/-	12/6
Elec. Construction	£1	23/9		8½	8½	7 2 3	29/9	23/9
Elliott Bros.	5/-	32/6		19	17½*	2 13 9	36/9	24/6
Enfield Cable Ord.	£1	13/9		Nil	Nil	Nil	19/3	13/6
English Electric	£1	48/9	−1/3	12½	12½	5 2 6	66/3	47/3
English Electric 3¾% Pref.	£1	13/-		3¾	3¾	5 15 6	14/6	12/6
Ericsson Tel.	5/-	38/-		20†	20†	2 12 9†	42/9	33/6
Ever Ready	5/-	27/-	−6d	35	35	6 9 9	32/9	24/-
Falk Stadelmann	£1	36/9		15	17½	9 10 6	45/9	36/9
G.E.C. Ord.	£1	47/6x.d.	−1/6	12½	14	5 18 0	65/6	50/-
G.E.C. 6½% Pref.	£1	22/3		6½	6½	5 16 9	23/9	21/3
General Cables	5/-	12/3	+6d	30	30	12 5 0	13/9	11/3
Greenwood & Batley	£1	46/3		17½	17½	7 11 3	47/6	45/-
Hackbridge Cable	5/-	21/9		25	30	6 18 0	34/6	18/9
Hackbridge & Hewittic	5/-	18/9		30	23*	6 3 0	22/-	17/3
Heatrae	2/-	3/9		15	15	8 0 0	5/1	3/9
Henley's	10/-	16/9		10½	11½	6 17 3	19/9	14/-
Holophane	5/-	21/3	+3d	25	30	7 1 3	21/3	17/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend forecast.

appliances. While the latter continue to contribute the greater part of the group's turnover and profit, Mr. Pegley called attention to the renewal of the arrangements with Plessey, whereby that company performs the major part of the manufacturing operations, leaving Vactric free to devote its factory space in London to precision tooling and control equipment. He reported continuous expansion in these divisions. For the year ended last March, Vactric paid a dividend of 17½ per cent from earnings equivalent to over 90 per cent on the ordinary capital of £450,000. The 5s shares are quoted at 12s 6d, to yield 7 per cent, and the "A" (non-voting) shares at about 6d lower.

Electrical Investments

Company or Board	Nom. Value	Middle price 10th Sept.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield% £ s d	1956 Highest	1956 Lowest
Equipment and Manufacturing—continued								
Hoover	5/-	23/6		70	50	10 12 9	39/3	23/-
I.C.I.	£1	43/9	−6d	10	10	4 11 6	49/9	41/3
Intl. Combustion	5/-	19/6		25	20*	5 2 6	25/-	15/3
Johnson & Phillips	£1	41/3	+6d	15	15	7 5 6	46/6	37/6
Lancashire Dynamo	£1	42/-	−6d	15	11*	5 4 9	49/9	40/9
Laurence, Scott	5/-	15/9		12½	15	4 15 3	16/9	13/3
Lister, R. A.	£1	30/-		9·3	10	6 13 3	35/3	27/6
London Elec. Wire	£1	47/6	−9d	12½	12½	5 5 3	52/9	46/5
Lucas, J.	£1	32/6		7½	7½	4 12 3	40/3	29/6
Marryat & Scott	2/-	10/-		30	30	6 0 0	11/3	9/6
Mather & Platt	£1	55/-	+1/-	15	15	5 9 0	65/3	51/6
Metal Industries	£1	20/6	+6d	9	9	—	27/-	16/3
Midlands Elec. Mfg.	£1	45/-		10	12½	5 11 0	48/6	43/6
Morphy-Richards	4/-	20/-		35	50	10 0 0	27/3	20/-
Murex	£1	68/9	+2/6	20	20	5 16 3	70/3	60/-
Newman Ind.	2/-	2/3		10	10	8 17 9	2/9	2/1
Oldham & Son	1/-	2/6	+3d	20	17½*	7 0 0	3/-	2/3
Parnall (Yate)	5/-	5/6		14	12	10 18 3	9/6	5/6
Parsons, C. A.	£1	93/9	+6d	10	10	2 2 9	97/-	61/6
Plessey	10/-	70/3		27½	30‡	4 5 6	87/6	56/-
Pye "A" Deferred	5/-	17/-	−6d	12½	12½	3 13 6	21/3	14/-
Reyrolle	£1	116/3	+2/6	15	16½	2 16 6	116/6	81/-
Rheostatic	4/-	9/9x.d.		18½	12‡	4 19 0	—	8/3
Richardsons Westgarth	5/-	16/-		16⅝	16⅝	5 4 3	17/-	13/9
Scottish Cables	4/-	15/9		27½	27½	6 19 3	17/9	15/9
Smith (England), S.	4/-	11/-		17½	17½	6 7 3	14/3	10/6
Southern Areas	£1	17/6		10	7½	8 11 6	28/9	15/-
Strand Elec.	5/-	7/3		15	15	10 7 0	8/6	6/9
Sturtevant	5/-	23/3	+6d	14·4†	15†	3 4 6†	31/3	22/6
Sun Elec.	£1	33/9		15	20	11 17 0	37/6	35/-
Switchgear & Cowans	5/-	14/-		20	25	8 18 6	17/-	13/6
Taylor Tunnicliff	5/-	11/9		15	15	6 7 9	14/-	11/3
T.C.C.	10/-	41/3	−1/9	25	25	6 1 3	45/-	40/6
T.C. & M.	£1	28/-		8½	8½	6 1 6	34/-	26/-
Telephone Mfg.	5/-	7/6		10	10*	6 13 3	8/6	6/3
Thorn Elec.	5/-	16/3	−1/3	15	15	4 12 3	22/6	16/-
Thornycroft	£1	43/9	+9d	15	15*	6 17 3	49/9	41/3
Tube Investments	£1	58/9	−1/3	22½	14*‡	4 15 3	70/6	54/9
Vactric	5/-	12/6		15	17½*	7 0 0	15/-	11/6
Veritys	5/-	8/3	+3d	12½	12½	7 11 6	10/-	6/9
Walsall Conduits	4/-	13/-x.d.		70	20*	6 3 0	13/6	10/9
Ward & Goldstone	5/-	39/3		30	35	4 9 3	39/6	29/-
Watford	2/-	6/3		25	25	8 0 0	7/6	6/-
Westinghouse	£1	72/6		18	18	4 19 3	100/-	71/6
West, Allen	5/-	13/-	+3d	15	15	5 15 6	14/6	11/6
Wolf Electric	5/-	17/6		20	20	5 14 3	26/3	17/6
Trusts, Transport and Communications								
Anglo-Portuguese	£1	21/9		8	8	7 7 0	23/6	20/3
Brit. Elec. Traction: Def. Ord. "A"	5/-	18/-	−1/-	22½	22½	6 5 0	20/-	15/6
Cable & Wireless: Ord.	5/-	10/3		10	10	4 17 6	11/3	9/6
4% Loan	100	90½	−½	4	4	4 8 6	92½	88
Calcutta Trams	£1	27/6	+3d	6†	7½†	5 9 0†	27/6	23/-
Cape Elec. Trams	£1	17/6x.d.		8	8	8 11 5	20/3	18/-
Marconi Marine	£1	31/-		10	10	6 9 0	34/-	31/-
Oriental Tel. Ord.	1/-	70/-	+2/6	16	—	—	90/-	67/6
Telephone Rentals	5/-	10/9		12½	12½	5 16 3	11/9	9/9

Pye Report

Full accounts of the Pye company for 1955–56 confirmed the net profit, after tax, as being a little over the million mark, which is an advance on the previous figure and covers as much as five times over the amount of the dividend. The latter is kept at the previous rate of 12½ per cent. In the balance sheet there are substantial additions to fixed assets, debtors and stocks, financed by a combination of retained profits, last year's capital issue and larger loans. Profits are said to have fallen £100,000 short of expectations as a result of the increase in purchase-tax on radio and television sets, the prices of which were not raised. According to the report, it is the intention further to reduce the margin of profit in this field, and in conjunction with a still greater concentration on export markets, the result is likely to be some reduction in group profits for the present. The 5s "A" shares eased to 17s during the past week.

Thorn Electrical

As in the case of Pye, the full report from Thorn Electrical Industries reflects the infusion of large amounts of new money into the business, and corresponding increases in the amount of issued capital and of borrowing. In the market, the balance sheet was interpreted as implying some likelihood of a new issue of capital sooner or later. It was also taken into consideration that pressure on the group's resources should be relieved by the virtual completion of the lighting division's long-term re-equipment programme, but the price of the shares was put down 1s 3d to 16s 3d. As already known from the preliminary profits statement, group profits increased during the past year, although the net figure came out lower than before after deduction of larger amounts for taxation, depreciation and interest charges. The 15 per cent dividend remained covered between three and four times over by the surplus available for distribution and reserves.

Strand Electric Results

A yield of over 10 per cent is shown by Strand Electric Holdings 5s shares, at about 7s 3d, on the basis of the unchanged 15 per cent dividend now declared in respect of the year ended last April. A further improvement in the net taxed profit to £31,000 gives two-fold earnings cover for the dividend, and confirms the forecast, in last year's report, of satisfactory results. The company's major problem then was to cope with the volume of orders, and steps were being taken to enlarge the productive capacity. In the television field, the company was receiving substantial orders from the B.B.C. and from the commercial firms.

REPORTS and DIVIDENDS

Efco, Ltd.—The report and accounts for the year ended 31st March last now issued show a consolidated trading profit of £167,341, as compared with £255,584 for the preceding year. To the profit is added investment and other income, making £173,897, and after providing £76,358 for taxation, the net balance is £97,539 (against £139,859). As already announced the final ordinary dividend is 10¼ per cent, making 12½ per cent for the year, general reserve receives £60,000 and the balance carried forward is £30,383 (against £29,593 brought in).

In his statement, Mr. D. F. Campbell (chairman) says that fluctuations are to be expected in the heavy engineering industry, owing to the variable incidence of the completion of large contracts, within the accounting periods. The reduction in profit is primarily due to the lower demand for electric furnaces during 1955. On the other hand, marked progress has been made by the Electro-Chemical Engineering Co., Ltd. The order book at present is larger than at any time in the group's history, and the diversity factor adds some stability to the prospects, but competition is severe, especially in the export market, and rapidly increasing costs make long-term contracts somewhat speculative. Important contracts have been undertaken by their subsidiary and associate companies in Switzerland, Spain, South Africa and Canada, and operations in these countries are expanding. Since the end of the financial year the factories at Sheerwater and Hersham have both been completed and, in each case, work has been started on extensions to meet the increasing demand for their products.

Thorn Electrical Industries, Ltd.—The preliminary figures of the financial results for the year ended 31st March last, which were published in our issue of 24th August, are confirmed by the full report and accounts now issued. In his review of the year, Mr. J. Thorn (chairman and managing director) says that the Atlas lighting division has again had a record year. The long-term capital investment programme for this division is practically complete and the lamp factories have been re-equipped with modern high-speed automatic machinery, designed and built by their own mechanical engineering department. They recently installed an automatic unit, the only one of its kind in Europe, for the manufacture of 8ft tubes, and this enabled them to make a substantial reduction in price. Mr. Thorn claims that their output of fluorescent tubes exceeds that of the whole of the rest of the industry and that they are contributing three-quarters of the country's total fluorescent tube exports. They are one of the three largest producers of tungsten filament lamps in the United Kingdom and in this field they have further expanded the volume of their output.

The extension of the company's lamp factory at Merthyr Tydfil has now been completed and has doubled their capacity there. The "Atlas Softlight" lamp is already selling in substantial quantities. In the street lighting field the range of lanterns is rapidly gaining approval of public bodies and they have orders for several large installations on main trunk roads throughout the country. New fluorescent lighting developments include the "Atlas Kitchenlight" for the home. A complete section of the Spennymoor works has been allocated to the production of fluorescent fittings designed to the specific requirements of individual customers. Ekco-Ensign, Ltd., also made progress during the year under review and contributed to the success of the group's lighting division.

In view of the prevailing conditions in the field of cathode ray tubes, the board has decided to postpone the project for the manufacture of these tubes. The Ferguson Radio and Television Division continues to expand. The building of the Sylvania-Thorn colour T.V. laboratories is nearing completion and the official opening is planned to take place early in October. With regard to domestic equipment the Tricity "Trivet" grill-boiler and the Tricity "Coronet" cooker have received wide commendation; their share of the cooker market continues to increase and they have plans to extend their range of models. The factories in South Africa, Australia and New Zealand continue to develop and they are at present completing plans for the assembly of television receivers in Australia.

The Telegraph Condenser Co., Ltd., announces that as forecast in the chairman's last statement to shareholders, profits for the first half year of 1956 are materially lower and the deterioration in profit in the second half year is unpredictable. Nevertheless the directors have decided to pay an interim dividend of 5 per cent, but this should not be taken to indicate that last year's final dividend of 20 per cent will be maintained.

A. Reyrolle & Co., Ltd., have declared an interim ordinary dividend of 6½ per cent (against 6¼ per cent).

International Combustion (Holdings), Ltd., has declared an interim dividend of 7½ per cent (unchanged).

New Companies

R. F. Sims Electronics, Ltd.—Registered 7th August. Capital £100. Manufacturing electronic engineers, manufacturers of coil winders and electronic test and control gear, etc. Directors: R. F. Sims and R. H. F. Bone. Regd. office: 20, Bloomsbury Square, W.C.1.

H. F. Sheffield, Ltd.—Registered 7th August. Capital £5,000. Manufacturers of and dealers in television and radio sets, etc. Directors: H. F. Sheffield and Eileen E. Sheffield. Regd. office: 48, Meadow Road, Kingswood, Watford, Herts.

Telecommander (Canada), Ltd.—Registered 1st August. Capital £100. Manufacturers of and dealers in radio transmitting and receiving sets, electronic apparatus and components, etc. Directors: A. T. G. Fairbrass and E. S. Smith. Regd. office: 5, Great Winchester Street, E.C.2.

Electrolab, Ltd.—Registered 1st August. Capital £3,000. To acquire the business of an electronic, radio, television and general electrical engineer carried on by Thelma Hartman at Redland, Bristol, 6, etc. Directors: L. Hartman and Mrs. Thelma Hartman. Regd. office: Clyde Lane, Redland, Bristol.

L. C. P. Electrical Co. (Winchester), Ltd.—Registered 8th August. Capital £1,000. Manufacturers of and dealers in dynamos, motors, armatures, etc. Directors: P. J. Clark, V. R. Lewis and C. W. R. Price. Regd. office: 58, The Avenue, Southampton.

Radar Electronic Engineering, Ltd.—Registered 8th August. Capital £1,000. Directors: L. P. Goddard and C. H. Watts. Regd. office: Ferry Lane, Hythe End, Staines, Mdx.

Harold R. Lovegrove & Sons, Ltd.—Registered 14th August. Capital £1,000. Electrical engineers and contractors, etc. Directors: H. R. Lovegrove and H. R. Fortescue. Regd. office: Rear of Beckley Garage, Leatherhead Road, Great Bookham, Surrey.

P. D. Overell & Co., Ltd.—Registered 10th August. Capital £100. Electrical, mechanical and installation engineers and sheet metal workers, manufacturers of and dealers in forgings, castings, dynamos, batteries, motors, armatures, etc. Directors: P. D. Overell and W. F. Bates. Regd. office: 18, Essex Street, W.C.2.

Increase of Capital

Modern Telephones (Great Britain), Ltd.—Increased by £10,000 in £1 ordinary shares, beyond the registered capital of £50,000.

Liquidations

C. Drewery (Electrical), Ltd.—Particulars of claims by 30th September to the liquidator, Mr. S. D. Moore, 4, Silver Street, Hull.

Eagle Wireless Supply Co., Ltd.—Members' voluntary winding-up. Meeting of members on 8th October at 9-11, Dormer Place, Leamington Spa, to receive an account of the winding-up by the liquidator, Mr. J. A. Stancer.

Midway (Radio & Television), Ltd.—Winding up voluntarily. Liquidators, Mr. H. C. Hedges, 4, Charterhouse Square, London, E.C.1, and Mr. B. Sherling, 123, Pall Mall, London, S.W.1, appointed 23rd August.

Kingsbury Winding Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. E. Talbot, 25, Newman Street, London, W.1, appointed 24th August. Particulars of claims to the liquidator by 14th September.

Bankruptcies

F. W. Perry, Heath Lodge, Cherrington Road, Hanwell, Middx., lately carrying on business at 45, Boston Road, Hanwell, electrical engineer.—Receiving order made 24th August on a creditor's petition.

W. B. McKelvey, 2, High Road, Drayton, Norfolk, electrical contractor. — Public examination 11th October at the Shirehall, Norwich.

R. J. Camden, 32, New Bridge Street, Exeter, electrical engineer.—Last day for receiving proofs for dividend 15th September. Trustee, Mr. G. C. Ehlers, 28, Baldwin Street, Bristol, 1.

M. S. Harris, formerly carrying on business as an electrical contractor and retailer, under the style of the Newbury Electrical Service, at 18, Oxford Road, Newbury, Berks.—Application for discharge to be heard on 22nd October, at the Assize Court, Forbury, Reading, Berks.

H. J. Walby, lately carrying on business under the style of Theale Electric, at 86, Hill Rise, Richmond, Surrey, electrical engineer.—Application for discharge to be heard on 10th October, at the Court House, Garratt Lane, Wandsworth, London, S.W.18.

GENERATION AND DEVELOPMENT

Installation Testing

Billingham - on - Tees U.D.C. is recommending that the North Eastern Electricity Board should be responsible for testing electrical installations in all new houses, council and private, before they are occupied. The Durham County Urban District Councils' Association has been asked to take up the matter.

Renewal of Installations

After hearing a report by its engineer and surveyor on the state of the wiring in pre-war council houses the Pewsey Rural Council's Public Health and Housing Committee has decided to consider the adoption of a standard installation of lighting and power points and the replacement of all old wiring. The existing installations were said to be inadequate and in a dangerous condition.

Belfast Annual Report

In his annual report for the year 1954-55, Mr. R. P. Watson, city electrical engineer and general manager of the Belfast city electricity undertaking, drew attention to the fact that the full impact of wage awards that year and increasing loan charges in respect of the large development programmes in progress had not then been felt. In his report covering the year ended 31st March last he says that the effect of these charges, together with that of subsequent salary and wage awards and still further rising costs, are reflected in the financial results, the net surplus being £13,643, as compared with £114,419 for 1954-55. The increases in loan charges, salaries and wages during the year amounted to approximately £190,000 and he says that it is anticipated that these items will account for a further increase of similar magnitude during the current financial year. It is evident that improvement in generating efficiency and the increased sales at present tariffs no longer offset the rate at which the several components (excluding coal) of the working costs continue to rise, and at the same time provide a reasonably adequate surplus. He therefore recommends an increase of approximately 7½ per cent on the basic rates for all supplies other than those afforded to the shipyards, the city transport, public street lighting and traffic signs which are subject to special arrangements, the increase to take effect after the meter readings for the third survey period of 1956. This recommendation has since been approved by the City Council. Mr. Watson warns that the 7½ per cent is a minimum figure and should there be a falling off in sales during the current year, or any further increase in costs, it may be necessary to review tariffs again.

During the year under review sales of electricity totalled 440·6 million kWh, an increase of just over 3 per cent as compared with 1954-55. From the accompanying table it will be seen that while public lighting, domestic and power consumption rose, there was a falling off in the demand by the shipyards and the Transport Department.

Class of Consumer	1955/56 Million kWh	1954/55 Million kWh	Inc. or Dec. %
Lighting	28·1	26·2	+6·999
Domestic... ...	122·6	116·2	+5·513
General power ...	218·8	210·7	+3·861
Shipyards... ...	42·2	45·1	−6·530
Transport Dept....	28·9	29·2	−0·951
Totals	440·6	427·5	+3·077

On the domestic side requests for cooking and water heating equipment under the Department's hire and hire-purchase schemes reached a record, almost 5,000 additional appliances being supplied to consumers. The total number of consumers connected to the system at 31st March last was 141,987, an increase of 3,121 over the previous year.

A total of 80 miles of underground cables and overhead lines was added to the distribution system, made up of 19 miles of h.v., 35 miles of l.v. and 26 miles of service connections, bringing the total to 2,566 miles on the system. During the year the 110,000 V duplicate interconnector, consisting of two 3-core 0·3 sq in oil-filled cables, between the West power station and Donegall distributing station was commissioned, together with the associated 75,000 kVA transformers.

Electricity generated at the three power stations totalled 608·9 million kWh (against 544·6 million kWh). Coal consumption was 333,577 tons (312,989 tons) equivalent to 1·227 lb (1·287 lb) per kWh generated, the average cost per kWh generated being 0·5595d (0·5306d).

All the major contracts have been placed for the extensions to the West power station, which will consist of three 60 MW hydrogen cooled turbo-alternators and associated boiler plant. It is anticipated that the first of these three sets will be ready for service before the winter of 1957-58.

Cooker Installations Postponed

Owing to the need for economy, the Durham R.D.C. has been asked by the Ministry of Housing and Local Government to postpone its proposal to spend £2,000 on the provision of electric cookers in council houses. The matter will be reconsidered in six months' time.

Liverpool Overhead Railway

A proposal that the Council should provide financial guarantees to enable the Liverpool Overhead Railway to continue in operation until next June has been rejected by the Liverpool City Council. At the Council's meeting on 5th September it was decided to ask the Government to take the necessary steps to secure the continued running of the railway.

The Liverpool Overhead Railway Co. has obtained Parliamentary sanction to the closing of the line at the end of this year because of the high cost of repairs and maintenance.

Coal Transporter Breakdown

On Thursday last week part of the structure of the coal transporter at Kingston-on-Thames power station collapsed and put the transporter out of action. The transporter is employed for unloading coal from stock to conveyor belts which carry it to the station bunkers. Repairs are expected to take a considerable time and until they are completed coal will be taken by the conveyor belts directly from the barges which deliver it.

Repairs in Council Houses

Oldham Corporation Housing Committee has decided that the electrical repairs in Council houses shall in future be undertaken by the Corporation's Wiring Department, the cost to be charged to the tenants except in the case of aged and blind persons. The committee received letters from No. 3 Sub-Area, North Western Electricity Board, and the local branch of the Electrical Contractors' Association pointing out the dangers of tenants repairing fuses, plugs and switches themselves.

Southend's 100,000th Consumer

The one hundred thousandth consumer given a supply of electricity in the Southend District by the Eastern Electricity Board was connected on Wednesday of last week and to commemorate the occasion Mr. J. Linton, the district manager, presented Mr. and Mrs. H. V. Passingham, of Bell House Road, Southend, with a steam iron.

Mr. J. Linton, Southend District manager, Eastern Electricity Board, making a presentation to the 100,000th consumer

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 19th September from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1951

22301. Macfarlane Engineering Co., Ltd., Macfarlane, W. I., and Macfarlane, J. C.—Electric generators. 29th September, 1952. (757304.)

1952

593. Soc. Anon. pour les Applications de l'Electricité et des Gaz Rares-Etablissements Claude-Paz & Silva.—Electric discharge apparatus containing a gas absorbent material. 8th January, 1952. (757481.)

2917. British Thomson-Houston Co., Ltd.—Electric-discharge devices. 4th February, 1952. (757307.)

3965. Edison Swan Electric Co., Ltd.—Mounting of electric lighting units. 26th January, 1953. (757482.)

19805. Aircraft-Marine Products, Inc.—Electrical connector and method of connecting it to a wire. 6th August, 1952. (757311.)

28488. Macfarlane, J. C., Macfarlane, W. I., and Macfarlane, J. W.—Electric generators. 16th July, 1953. (757316.)

1953

7102. Hyde, G. A. M.—Electric cables and waveguides. 2nd March, 1954. (757490.)

17598. Electric & Musical Industries, Ltd.—Sawtooth current generators. 25th June, 1954. (757593.)

18719. Elliott Bros. (London), Ltd.—Electrical strain gauge load-measuring devices. 6th October, 1954. (757211.)

21218. Staatsbedrijf der Posterijen, Telegrafie en Telefonie.—Telephone systems and apparatus. 30th July, 1953. (757596.)

21646. British Insulated Callender's Cables, Ltd.—Insulated electric cables and impregnating compounds therefor. 4th August, 1954. (757395.)

21737. Philips Electrical Industries, Ltd.—Overload clutches. 6th August, 1953. (757598.)

22150. National Research Development Corporation.—Transistor amplifier circuits. 26th August, 1954. (757214.)

25199. Dubilier Condenser Co. (1925), Ltd., and Dubilier, W.—Electrical suppressor capacitor arrangements. 10th September, 1954. (757342.)

25737. Diamond H Switches, Ltd.—Rotary cam actuated electrical switches. 14th September, 1954. (757344.)

26574. Patentverwertung W. Reimers Ges.—Electrical variable speed system or gear. 28th September, 1953. (757515.)

27406. Western Electric Co., Inc.—Electron-discharge devices. 6th October, 1953. (757605.)

28349. General Electric Co.—Electric heating panels. 14th October, 1953. (757221.)

28821. Trix Vereinigte Spielwarenfabriken Ges.—Means for connecting an electrically operated toy vehicle to electric supply mains. 19th October, 1953. (757222.)

29079. British Thomson-Houston Co., Ltd.—Measurement of electric fields in waveguides. 20th October, 1954. (757402.)

29081. General Electric Co.—Insulating structures. 21st October, 1953. (757520.)

29795. General Electric Co., Ltd., Croft, R. M., and Roberts, T.—Apparatus for imparting rotary movement. 11th October, 1954. (757609.)

30338. Standard Telephones & Cables, Ltd.—Synchronising arrangements in electric telegraph systems. 29th October, 1954. (757612.)

31989. Goldsmith, W. L.—Electric water heaters. 18th November, 1954. (757352.)

32941. Telefunken Ges.—Amplifying or mixing circuits. 27th November, 1953. (757527.)

33751. National Research Development Corporation.—Control arrangements for electronic digital computers. 26th November, 1954. (757356.)

34537. Ferranti, Ltd.—Arrangements for mounting electric cables. 13th December, 1954. (757357.)

35660. Brentford Transformers, Ltd.—Electrical contact devices movable axially along current carrying coils. 7th December, 1954. (757237.)

35860. Siemens Bros. & Co., Ltd.—Electrical coupling circuits. 3rd December, 1954. (757624.)

35890. Klein, S.—Electric transducers. 24th December, 1953. (757358.)

35923. British Vacuum Cleaner & Engineering Co., Ltd.—Agitator for power-operated domestic washing-machine. 2nd December, 1954. (757412.)

36185. Philips Electrical Industries, Ltd.—Muliplex television signalling systems. 30th December, 1953. (757238.)

1954

463. Rotax, Ltd. — Electro-magnetic switches. 6th January, 1955. (757415.)

898. Crompton Parkinson, Ltd.—Arc welding of studs and similar members. 11th January, 1955. (757417.)

1327. Marconi's Wireless Telegraph Co., Ltd.—Reactance valve circuit arrangements. 22nd November, 1954. (757629.)

2663. Thorn Electrical Industries, Ltd.—Control of electric circuits. 5th January, 1955. (Cognate application 17471, 14th June, 1954.) (757359.)

2823. Carr Fastener Co., Ltd.—Two-part electrical connectors. 7th January, 1955. (757360.)

3232. British Thomson-Houston Co., Ltd.—Electric control apparatus. 2nd February, 1955. (757536.)

4548. Metropolitan-Vickers Electrical Co., Ltd.—Means for flash-over prevention. 16th February, 1955. (757363.)

6052. Allday & Son (1922), Ltd., H.—Wall boxes for containing electric switches, or other circuit controlling or connecting means. 18th February, 1955. (757437.)

6651. Chamberlain & Hookham, Ltd., and Deacon, L. O.—Electrical terminal blocks. 2nd March, 1955. (757366.)

7006. Venner, H. A. L. (Veb C. Zeiss Jena).—Devices for converting an ultrasonic image into a visible electron image. 10th March, 1954. (757248.)

7204. British Insulated Callender's Cables, Ltd.—Manufacture of insulated electric conductors. 11th March, 1955. (757249.)

8464. Radio Corporation of America.—Preamplifier for colour television. 23rd March, 1954. (757439.)

8590. Cazzaniga, C. A.—Electrical devices for the automatic control of washing machines. 24th March, 1954. (757440.)

8985. Smith & Sons (England), Ltd., S.—Speed-responsive electric switches. 1st April, 1955. (757,422.)

9439. Western Electric Co., Inc.—Apparatus for welding contacts on to wires of electrical relay components. 31st March, 1954. (757643.)

9739. Sperry Corporation.—Electronic computers. 2nd April, 1954. (757251.)

11152. Standard Telephones & Cables, Ltd.—Radio frequency amplifier. 15th April, 1954. (757428.)

11167. English Electric Co., Ltd.—Internal-combustion engines. 7th April, 1955. (757552.)

12261. Bosch Ges., R.—Self-sealing electric condensers. 28th April, 1954. (Addition to 728566.) (757557.)

12311. Western Electric Co., Inc.—Electron beam focusing systems. 28th April, 1954. (757369.)

12598. English Electric Co., Ltd.—Electric switchgear. 29th July, 1955. (757441.)

13001. Gugelberg, A. von (trading as Elesta, Elektronische Steuerapparate, Dr. A. von Gugelberg).—Regulating apparatus. 4th May, 1954. (757442.)

13110. Telefonaktiebolaget L. M. Ericsson.—Electron-discharge tubes. 5th May, 1954. (757444.)

13137. Radio Heaters, Ltd.—Radio-frequency heating equipment. 5th May, 1955. (757445.)

13408. General Electric Co., Ltd., and Parton, K. C.—Control apparatus for electric motors. 6th May, 1955. (757646.)

13689. Lucas (Industries), Ltd., J.—Magneto electric current generators. 3rd May, 1955. (757371.)

15432. British Thomson-Houston Co., Ltd.—Fluorescent electric-discharge lamps. 25th May, 1954. (757565.)

19224. Kocks Ges., F.—Pressure welding with electric induction heating apparatus. 30th June, 1954. (757655.)

19438. Standard Telephones & Cables, Ltd.—Blocking layer rectifiers. 2nd July, 1954. (757452.)

21298. Fischer Akt.-Ges., G.—Electrical drive arrangements for machine tools. 21st July, 1954. (757456.)

21649. Chan, M. L.—Electric cells. 23rd July, 1954. (757660.)

23248. General Electric Co.—Dispenser cathodes. 10th August, 1954. (757272.)

23823. Cinch Manufacturing Corporation.—Sockets for thermionic valves, electrical plugs or other electrical devices having projecting terminal prongs. 16th August, 1954. (757459.)

24768. Bendix Aviation Corporation.—Method of crystal switching for high frequency oscillators. 25 August, 1954. (757665.)

25406. General Electric Co.—Adjustable resistors. 1st September, 1954. (757462.)

25624. Western Electric Co., Inc.—Amplifier with mismatched interstage networks. 3rd September, 1954. (757669.)

25625. Western Electric Co., Inc.—Frequency modulation system for transmitting colour television signals. 3rd September, 1954. (757670.)

26435. Aktiebolaget Karlstads Mekaniska Werkstad.—Device for the prevention of racing of a water turbine having controllable runner blades. 13th September, 1954. (757575.)

26817. Siemens-Schuckertwerke Akt.-Ges.—Melted-on electrodes for semi-conductor apparatus. 15th September, 1954. (757672.)

27977. Western Electric Co., Inc.—Frequency stabilised oscillatory systems. 28th September, 1954. (757464.)

28143. Empresas Dualex Internacionales Soc. Anon. — Electro-magnetically-operated vibrating reed assemblies, particularly electro-magnetic interrupters. 29th September, 1954. (757677.)

28325. Westinghouse Electric International Co.—High-voltage electric-discharge tubes. 1st October, 1954. (757465.)

28477. Sulzer Frères Soc. Anon.—Axial-flow turbines and compressors. 4th October, 1954. (757577.)

29627. Mullard Radio Valve Co., Ltd.—Loading coil arrangements. 14th October, 1954. (757284.)

31070. Compagnie Générale d'Electricité—Electric meter panels. 27th October, 1954. (757287.)

32927. Minister of National Defence of H.M. Canadian Government.—Magnesium cuprous chloride electric battery. 11th November, 1954. (757473.)

34832. Soc. Alsacienne de Constructions Mécaniques.—Pulse-modulation intelligence transmission systems. 1st December, 1954. (757290.)

35769. Sulzer Frères Soc. Anon.—Steam power plants employing forced flow steam generators. 10th December, 1954. (75729[illegible].)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—8th October. Department of Public Works, New South Wales. Electrically-driven deep-well type pumping plant. (E.S.B. 22482/56. Ten/21222.)*

Birmingham.—24th September. Watch Committee. Electrical installation in Bradford Street police station, 12. Sir Herbert J. Manzoni, city engineer, Civic Centre, 1.

Burma.—1st October. Director General, Union Purchase Board. 30 electric table fans. (E.S.B. 22256/56. Ten/21167.)* 2nd October. Cable. (E.S.B. 22259/56. Ten/21156.)* 4th October. Fuses, fluorescent lamps and fittings, unit or dry cell batteries for torches. (E.S.B. 22521-3/56. Ten/21260-2.)* Transformer and switchgear oil testing equipment. (E.S.B. 22546/56. Ten/21283.)*

Cockermouth.—6th October. U.D.C. Street lighting equipment. (See this issue.)

Costa Rica.—24th September. Electric transmission towers (amended tender). (E.S.B. 12438/56. Ten/19315A.)*

Dunbarton.—28th September. C.C. Street lighting equipment. (See this issue.)

India.—22nd October. Government of Madras. Indoor and outdoor switchgear for substations. (E.S.B. 22554/56. Ten/21273.)* 4th October. Director-General Supplies and Disposals, New Delhi. H.v. and l.v. cable. (E.S.B. 22488/56. Ten/21277.)* 5th October. Asbestos tape. (E.S.B. 22487/56. Ten/21276.)*

Londonderry. — 29th September. City Council. Electrical installations in 76 houses being erected at Rossdowney, Waterside. House architect, 5, Guildhall Street.

New Zealand.—21st September. Electricity Department, Dunedin City Corporation. 6,600 V cable. (E.S.B. 22315/56. Ten/21170.)* 12th October. Auckland Electric Power Board. V.i.r. triple braided cable. (E.S.B. 22412/56. Ten/21213.)* 17th October. Post and Telegraph Department, Wellington. Telephone cable. (E.S.B. 22683/56. Ten/21887.)*

Pakistan.—3rd October. Posts and Telegraphs Department. 50 linemen's portable telephone sets. (E.S.B. 22137/56. Ten/21249.)*

Port Talbot.—25th September. Town Council. Electrical installations in 18 houses at Aberavon. Borough surveyor, Municipal Buildings.

Portuguese East Africa.—21st September. Ports, Railways and Transport Department, Lourenço Marques. Electrical equipment including induction meters, fuse cut-outs, contactor and circuit-breaker, motor starters, etc. (E.S.B. 22344/56. Ten/21195.)*

South Africa.—27th September. Union Tender and Supplies Board. Drop wire. (E.S.B. 22123/56. Ten/21224.)* 650,000 wiring buckle clips. (E.S.B. 22437/56. Ten/21217.)* 28th September. Stores Department, South African Railways. Open wire carrier telephone systems. (E.S.B. 22140/56. Ten/21247.)* 3rd October. Four 400 V, 5 MVA switchboards. (E.S.B. 22552/56. Ten/21229.)* 3rd October. Batteries. (E.S.B. 22551/56. Ten/21267.)* 5th October. City of Durban, Electricity Department. 44 floodlight projectors for illuminating a football ground. (E.S.B. 22176/56. Ten/21171.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

17th October. City Engineer's Department, Cape Town. Steam plant including electrical equipment for the municipal abbattoir. (E.S.B. 22149/56. Ten/21183.)*

Spain.—15th October. Union Electrica Madrilena, Madrid. Circuit-breakers with protectors. (E.S.B. 23010/56.I.C.A. Ten/21316.)*

Stamford.—1st October. Borough Council. Street lighting equipment. (See this issue.)

Todmorden.—22nd September. Borough Council. Street lighting equipment. (See this issue.)

Uruguay.—19th October. Administracion General de las Usinas Electricas y los Telefonos del Estado. Electrolytic copper conductors for telephone lines. (E.S.B. 22624/56. Ten/21285.)* 22nd October. Conductors with black outdoor insulation. (E.S.B. 22623/56. Ten/21301.)* 24th October. Double copper conductors covered with plastic material. (E.S.B. 22622/56. Ten/21300.)*

ORDERS PLACED

Leeds.—Regional Hospital Board. Accepted. Electrical installation work in connection with alterations to the wards at the Leeds Road Hospital, Bradford (£4,346).—A. Innes, Ltd.

Newcastle-on-Tyne. — Regional Hospital Board. Accepted. Electrical work at the new admission block and convalescent villas at St. George's Hospital, Morpeth, Northumberland (£28,903).—Watson-Norie & Co., Ltd. Electrical installation work at the new employment block and at three male villas at the Prudhoe and Monkton Hospital, Prudhoe, Northumberland (£7,152).—Veale-Nixon & Co., Ltd. Electrical installation work at the Dryburn Hospital at Durham (£1,125).—Fairbairn & Partners, Ltd.

Sheffield. — Corporation Markets Committee. Accepted. Six switchgear panels for the slaughterhalls at the abattoir (£1,212).—Brookhirst Switchgear, Ltd.

Warrington.—Corporation Welfare Services Committee. Accepted. Installation of bed lifts at Whitecross Homes (£5,108).—Etchells, Congdon & Muir, Ltd.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aylesbury.—Houses (61) at Cuddington, Halton and Stone; surveyor, Rural Council Offices, Buckingham Street.

Barrow-in-Furness. — Church of St. Columba, Church Lane; Cruickshank & Seward, 196, Deansgate, Manchester.

Bournemouth.—Bank premises, Kinson Road and Wimborne Road; Lloyds Bank, Ltd., 71, Lombard Street, London, E.C.4.

Bracknell.—Factory and offices; Wayne Tank & Pump Co., Ltd., 42, Newlands Park, London, S.E.26.

Brighouse.—Houses (61), on estates at Field Lane and Stoney Lane; H. A. Sneezum, borough surveyor, Commercial Street.

Bristol.—Offices in Wine Street (£400,000); Shell Mex & B.P., Ltd., Head Office, Shell Mex House, Strand, London, W.C.2.

Cheshunt.—C. of E. secondary school; H. G. Cherry & Partners, 38, Gordon Square, London, W.C.1.

Chesterfield.—Office block, Derby Road; B. Y. Jackson & Son, Ltd., Smalley Green, Smalley.

Crawley.—Houses (100), Rusper Road, Ifield; Wates, Ltd., 1258, London Road, London, S.W.16.

Darlington.—Houses (50) on the Branksome estate; E. A. Tornbohm, borough architect, Central Buildings.

Dewsbury.—Houses (158), Ouselwell Lane; borough architect.

Dukinfield.—Three-storey factory and two-storey offices, Bridge Street/Gate Street site; Nathan Brown Proprietaries, Ltd., 67, Wellington Road, Stockport.

Durham.—New county offices (£1,500,000); G. R. Clayton, county architect, Shire Hall.

Easington.—Houses at Murton (38), and Easington (26); R. Lumsden, surveyor, Rural Council Offices.

Felixstowe.—Four laboratories, gymnasium, changing rooms, etc., as extensions to County Grammar School (£60,000); East Suffolk county architect, County Hall, Ipswich.

Guildford.—Four-storey extension to girls' county grammar school, Farnham Road; J. Harrison, Surrey county architect, County Hall, Kingston-on-Thames.

Houses (55), Boxgrove Road; Geo. Wimpey & Co., Ltd., 23, Hammersmith Grove, London, W.6.

Halesowen.—Flats (54), Cradley estate; borough surveyor.

Harlow.—Works; British Oxygen Co., Ltd., Bridgwater House, Cleveland Row, London, S.W.1.

Hereford.—Bank and offices, St. Peter Street corner site, for West Midland Savings Bank; Scriven, Powell and James, architects, Cathedral Chambers, King Street.

Hillingdon.—Maternity unit at Hillingdon Hospital (£288,000), for North West Metropolitan Regional Hospital Board; regional architect, Sheffield House, Sheffield Street, London, W.C.2.

Huddersfield. — Houses (102), and old people's home on the Fearnside estate; borough architect, High Street Buildings.

Hyde.—Works in Dukinfield Road; Joseph Adamson and Co., Ltd., P.O. Box 4, Hyde.

Johnstone.—Houses (487), on Johnstone Castle site; burgh surveyor.

Kidderminster.—St. Oswald's Church, Broadwater; Maurice W. Jones, 1, College Yard, Worcester.

Three 2-storey classroom blocks, assembly hall, and blocks comprising kitchen, boiler house, workshop and gymnasium, at Sion Hill, for Worcs. E.C.; Frederick Gibberd, architect, 8, Percy Street, London, W.1.

Leatherhead.—Crematorium at Randalls Park; J. L. Davis, surveyor, Urban Council Offices.

London.—Flats (70), Seymour Street, Marylebone; Harry Neal, Ltd., 117, Baker Street, W.1.

Secondary school, Risinghall Street, Shoreditch; Wm. Crabtree, 8, Robert Adam Street, W.1.

Offices, Poland Street, Westminster: Higgs & Hill, Ltd., Crown Works, South Lambeth Road, S.W.8.

Flats (24), St. Paul's Avenue and Willesden Lane; borough engineer, Willesden.

Mansfield.—Houses (192), St. Ives Farm estate, Westfield Lane; Butterley Co., Ltd., Ripley, Derbys.

Peel (I.o.M.).—Town hall, Derby Road; Davidson Marsh & Co., architects, 16, Athol Street, Douglas, I.o.M.

Plymouth.—Dwellings (40), Clowance Street; city architect.

Portsmouth. — Four-storey office block, King's Terrace; C. A. Claxon, Penny Street.

Reading.—Houses (40), St. Michael's estate; borough architect.

Works and offices, London Street; Reading Standard, Ltd., Valpy Street.

Rugby.—Houses (51), Bromwich Road; Browning Construction Co., Ltd., 19, Hillmorton Road.

South Shields.—Factory at Simonside for Barbour & Son; Gordon Durham and Co., builders, Moor Lane, East Boldon.

Factory at West Holborn for Rapide, Ltd., photographic manufacturers; J. Cummings, builder, Matamba Terrace, Sunderland.

Spalding.—High school for girls; county architect, Boston, Lincs.

Stockport.—Conversions at old Palladium Cinema and adjoining property, Prince's Street, to form departmental store; Henry's Stores, Ltd., 95, Market Street, Manchester.

Stockton.—Houses (96), Hardwick; borough architect.

Taunton. — Houses (111), Greenway, Bishops Lydiard, for R.D.C.; H. S. W. Stone & Partners, architects, 20, The Crescent, Taunton.

Thornbury.—Flats and bungalows (40), at Gloucester Road, for R.D.C.; Rainger, Rogers & Smithson, Council's architects, Glenmore Lodge, Wellington Square, Cheltenham.

Twickenham. — Four-storey maisonnettes and three-storey flats at Little Queen's Road housing site, Teddington; A. S. Knolles, borough engineer, Municipal Offices.

Upton-on-Severn. — County secondary school; Thomas Broad, Ltd., 16, Graham Road, Malvern.

Wallsend.—Workshops for Swan, Hunter & Wigham Richardson, Ltd.; Demolition & Construction Co., Ltd., 3, St. James's Square, London, S.W.1.

Factory additions for Swinburne and Sons, brassfounders, etc.; J. Moore, builder, 183, High Street.

Walton (Surrey).—Municipal offices and Council chamber in New Zealand Avenue; E. A. Lister, U.D.C. surveyor, Council Offices, Walton-on-Thames.

Whitley Bay.—Houses on 95 acres of land near Murton Village; W. Leech, Ltd., builders, St. James Street, Newcastle-on-Tyne.

Widnes.—Houses at Wyncroft Road (62), and at Green Oaks Farm (39); H. Nevile Player, borough architect, Brendan House, Widnes Road.

Wigton.—Council offices; R.D.C. surveyor, Wigton, Cumberland.

Woking.—Shops and offices (£60,000), for the Pearl Assurance Co., Ltd., High Holborn, London, W.C.1; A. J. & L. R. Stedman, architects, 36, South Street, Farnham, Surrey.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks, objections against which may be entered up to 22nd September:—

Design incorporating "Petbow." No. 745,799. Class 9. Welding apparatus; signalling apparatus, electrodes for welding, protective clothing, tachometers and ammeters; insulated electric wire and cables; and automatic or current controlled electrical apparatus for controlling the operation of motors and machinery. — Petbow, Ltd., Richborough Works, Sandwich, Kent.

ELECTOGLO. No. 751,893. Class 9. Luminous display signs.—Bernard Lipton, Anchor Works, Grovely Road, Christchurch, Hants.

SONOTONE. No. 751,993. Class 9. Gramophone pickups, storage batteries, electric cells, electric discharge tubes, thermionic valves, telephone receiving apparatus, amplifiers, microphones and transducers.—Sonotone Corporation, New York. Address for service: c/o F. J. Cleveland & Co., 29, Southampton Buildings, Chancery Lane, London, W.C.2.

CHELCO. No. 751,583. Class 11. Heating apparatus.—Chase Electric Co., Ltd., 6/10, Crompton Way, Crawley, Sussex.

FILTESSO. No. 746,898. Class 11. Gas heated and electrically heated apparatus for making coffee.—Jackson Boilers, Ltd., Vulcan Works, Shafton Lane, Leeds, 11.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates do not clash with others already arranged.

Monday, 17th September

BIRMINGHAM.—Grand Hotel, 6.15 p.m. Birmingham Electric Club. Presidential address, by D. E. Reynolds.

Monday, 17th September, to Tuesday, 25th September

GERMANY.—Institute of Metals. Autumn meeting in Stuttgart.

Tuesday, 18th September

GLASGOW.—A.S.E.E. Glasgow Branch. Visit to Babcock & Wilcox Renfrew factory, 7 p.m.

Tuesday, 18th September, to Friday, 21st September

BLACKPOOL.—Association of Public Lighting Engineers. Annual conference.

Wednesday, 19th September

BIRMINGHAM.—James Watt Institute, Great Charles Street, 7 p.m. Institution of Production Engineers, Midlands Region, Birmingham Section. Film evening—"Automation."

NOTTINGHAM.—A.S.E.E. Nottingham Branch. Visit to G.P.O. Telephone Exchange.

ROCHESTER.—King's Head Hotel, High Street, 7 p.m. Incorporated Plant Engineers, Kent Branch. "The Corrosion of Iron and Steel and Remedial Measures," by F. S. Bricknell.

Thursday, 20th September

BLACKBURN.—Golden Lion Hotel, 7.30 p.m. Incorporated Plant Engineers, Blackburn Branch. "The Maintenance of High Efficiencies on Economic Boilers," by I. S. Groundwater.

CANTERBURY. — County Hotel, 8 p.m. A.S.E.E. Kent Branch. "Nightstor Heater," by R. Fielding.

LEAMINGTON SPA.—I.E.S. Leicester Centre. Summer outing.

LONDON.—25, Foubert's Place, W.1, 2.30 p.m. Electrical Association for Women, London Branch. "At Home."

SOUTHAMPTON.—Polygon Hotel, 8 p.m. A.S.E.E. Southampton Branch. "Some Problems in Sound Production," by F. H. Brittain.

Friday, 21st September, to Saturday, 29th September

LONDON.—Earls Court. International Commercial Motor Transport Exhibition.

Saturday, 22nd September

OXFORD.—Collier Lecture Room, Regents Park College, Pusey Street, 6.30 p.m. A.S.E.E. Oxford, Reading & Districts Branch. "The Control of Automation," by L. Meeks.

CATALOGUES AND LISTS

CABLES.—44-page catalogue listing the company's range of rubber and thermoplastic cables and flexibles.—**Aerialite, Ltd.,** Castle Works, Stalybridge, Cheshire.

CONDUIT FITTINGS.—19-page illustrated and priced catalogue covering the company's range of conduit fittings.—**F. C. Blackwell & Co., Ltd.,** Great Crosby Works, Liverpool, 23.

CONNECTORS.—Loose leaf catalogue illustrating and describing the company's connector equipment for power electrical installations.—**Power Connectors, Ltd.,** 2, Caxton Street, London, S.W.1.

Folder and descriptive leaflet dealing with an aluminium line tap and transformer connectors for aluminium conductors.—**Bowthorpe Electric Co., Ltd.,** Tinsley Lane, Crawley, Sussex.

CONTROL BOARDS.—16-page catalogue (SG/229) illustrating and describing a new design of cubicle for control and relay boards and showing typical examples of such control boards.—**English Electric Co., Ltd.,** Switchgear Department, Stafford.

DOMESTIC APPLIANCES. — Folder covering the company's range of domestic electric irons, kettles and coffee percolators. —**Lincass Electric, Ltd.,** White Hart Yard, Guildford Street, Chertsey, Surrey.

Booklet covering the various domestic electrical appliances in the "Metway" range. —**Metway Electrical Industries, Ltd.,** Metway Works, Kemp Town, Brighton, 7.

DOMESTIC EQUIPMENT.—Priced 48-page catalogue illustrating the company's various electrical appliances, torches and decoration sets, etc., together with two broadsheets on mains operated and battery operated products respectively.—**Pifco, Ltd.,** Pifco House, Watling Street, Manchester, 4.

INSULATING MATERIALS.—Leaflet dealing with insulating materials classified in accordance with B.S. 2757:1956.—**Micanite & Insulators Co., Ltd.,** Empire Works, Blackhorse Lane, Walthamstow, London, E.17.

GRILLS.—Folder dealing with the range of "V" infra-red grills distributed by the company.—**Infra-Heat Co., Ltd.,** 22, Clifton Road, London, W.9.

LAMPS.—Descriptive leaflet on the company's 5ft 50 W bi-pin fluorescent tube for showcase lighting, etc.—**Longlamps, Ltd.,** 24, Marshalsea Road, London, S.E.1.

Catalogue (AL113) covering the company's range of general lighting service, fluorescent, automobile and other lamps.—**A.E.I. Lamp and Lighting Co., Ltd.,** Crown House, Aldwych, London, W.C.2.

LIGHTING FITTINGS.—120-page illustrated and priced catalogue (764) covering commercial, industrial and display lighting fittings and equipment.—**Sun Electrical Co., Ltd.,** 118-124, Charing Cross Road, London, W.C.2.

40-page catalogue (211) dealing with contemporary and other decorative and commercial lighting fittings produced by the company. —**Best & Lloyd, Ltd.,** Wattville Road, Handsworth, Birmingham, 21.

SPACE HEATING.—16-page illustrated and priced catalogue dealing with domestic space heating equipment.—**Falk, Stadelmann & Co., Ltd.,** 91, Farringdon Road, London, E.C.1.

SWITCHGEAR.—Consolidated price list, available in home and export editions, covering the range of switchgear, lighting fittings and cable accessories, etc., produced by the company.—**Dorman & Smith, Ltd.,** Ordsal Electrical Works, Manchester, 5.

Descriptive catalogue (SG/333) dealing with type OB2 air-break switchgear, and a folder describing condenser bushings for types OKM 6 and OKG 4 outdoor oil circuit-breakers.—**English Electric Co., Ltd.,** Switchgear Department, Stafford.

TELEPHONE EQUIPMENT. — Folder dealing with the company's unit type P.M.B.X. private manual branch exchange.—**Automatic Telephone & Electric Co., Ltd.,** Strowger Works, Liverpool, 7.

TEST EQUIPMENT.—Leaflet giving particulars of an earth-loop impedance test set.— **Foster Transformers, Ltd.,** South Wimbledon, London, S.W.19.

WATER HEATERS.—Broadsheet dealing with thermal storage water heaters for domestic requirements.—**Heatrae, Ltd.,** Norwich.